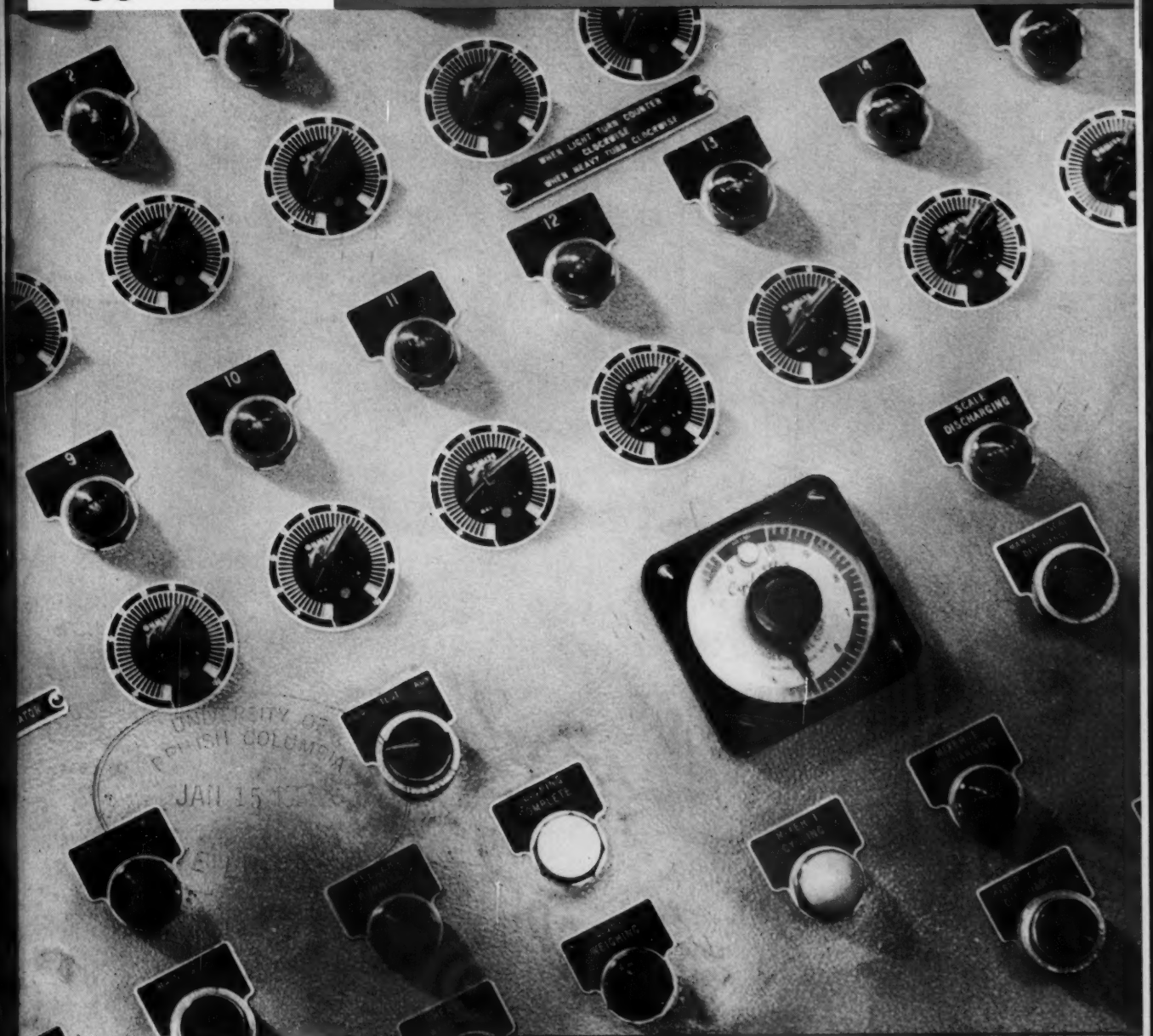
CEREAL SCIENCE today

35c PER COPY

JANUARY 1959 VOLUME 4 • NUMBER 1



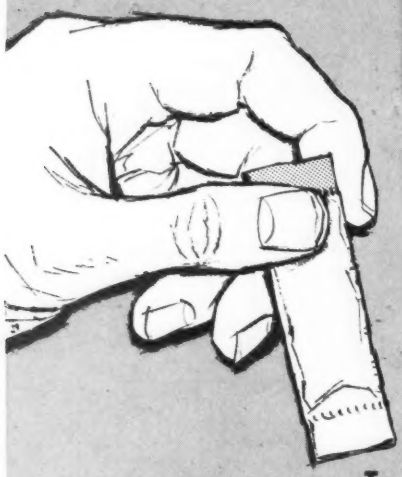
AN OFFICIAL PUBLICATION OF THE AMERICAN ASSOCIATION OF CEREAL CHEMISTS

OF INTEREST THIS MONTH

NORTHERN REGIONAL RESEARCH LABORATORY

GERMAN FEDERAL RESEARCH INSTITUTE

FUNGUS INFECTION OF GRAIN

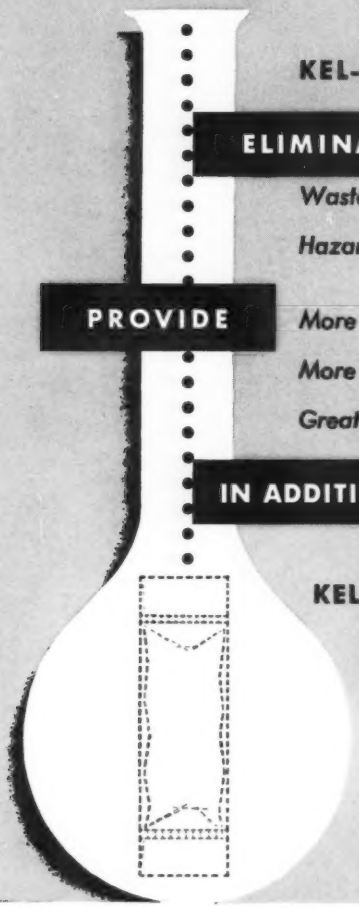


FOR YOUR CONVENIENCE

Harshaw KEL-PAK Digestion Catalyst Powders

Harshaw KEL-PAK Powders are carefully compounded mixtures of Potassium Sulphate; Mercuric Oxide and/or Copper Sulphate in sealed polyethylene packets containing sufficient catalyst for one protein determination.

To use, simply drop one packet into flask



KEL-PAK POWDERS

ELIMINATE
- *Messy mixing operations*
- *Waste due to spillage and spoilage*
- *Hazardous handling of mercury or its compounds*

PROVIDE
- *More uniform mixtures*
- *More accurate additions*
- *Greater speed in adding catalyst to flask*

IN ADDITION..
- *Polyethylene packet reduces foaming*

KEL-PAK POWDERS are available in 5 formulas

#1 9.9 grams K_2SO_4; .41 gram H_gO; .08 $CuSO_4$
#2 10 grams K_2SO_4; .3 gram $CuSO_4$*
#3 9 grams K_2SO_4; .35 gram H_gO*
#4 10 grams K_2SO_4; .7 gram H_gO*
#5 15 grams K_2SO_4; .7 gram H_gO*

* Meet A.O.A.C. specifications

Write for more information and prices today.

HARSHAW SCIENTIFIC
DIVISION OF THE HARSHAW CHEMICAL CO.
1945 East 97th Street • Cleveland 6, Ohio

Sales Branches and Warehouses

Cleveland 6, Ohio, 1945 East 97th St.
Cincinnati 13, Ohio, 6265 Wiehe Road
Detroit 28, Mich., 9240 Hubbell Ave.
Houston 11, Texas, 6622 Supply Row
Los Angeles 22, Calif., 3237 S. Garfield Ave.
Philadelphia 48, Pa., Jackson & Swanson Sts.

Sales Offices: Baton Rouge, La.• Buffalo 2, N.Y.• Pittsburgh 22, Pa.• Oakland 11, Calif. Hastings-on-Hudson 6, N.Y.

The Vital Story of MILLED WHITE RICE

Enriched with Vitamins and Iron for Better Health

by Science Writer

A second "Battle of Bataan" in the Philippines has proven beyond all doubt the value of vitamin enrichment to consumers of white rice.

The famous Bataan experiment in 1948-1950 proved conclusively that whole populations can benefit from enrichment of white rice with vitamins and iron, that disease and death caused by dietary deficiencies can be overcome, that enrichment is a key to better health among infants, children and adults.

What Happened at the Second "Battle of Bataan"

Before the start of the Bataan trial, these facts were evident:

- Polished white rice is the principal food of millions throughout the world. Good food though it is, it lacks several of the key nutrients occurring in the brown rice from which it is milled, and beriberi is often common where white rice is the main food.
- In the Philippines, beriberi was common and mortality from it high.
- Beriberi is caused by insufficient vitamin B_1 in the diet. It yields when vitamin B_1 is given to its victims. It does not occur when human beings receive enough of this vitamin in their diet.
- To prevent beriberi where white rice is the the main food, vitamin B_1 must be added to the diet, either by itself or in food such as rice.

- For centuries it has been universal practice to rinse rice before cooking, hence vitamin B_1 (and any other water-soluble nutrient factor) should be added in such a way that it will not dissolve out.
- Through a process developed in the laboratories of Hoffmann-La Roche, it is possible to enrich white rice with water-soluble vitamins and iron so they will not wash off during this rinsing prior to cooking.

With these facts known, the second "Battle of Bataan" began. Through the cooperation of Philippine public agencies, the Williams-Waterman Fund, the USPHS, and Hoffmann-La Roche a controlled experiment was set up in the province of Bataan. More than 12,000 medical examinations were made, before the enrichment of rice began. Nearly 13% of those examined had beriberi.

Enriched white rice was then put into commerce in the experimental area, but not in the control area.

What happened? *Within two years beriberi was practically wiped out in the experimental zone! . . .* beriberi mortality dropped almost to zero . . . almost 90% who had symptoms of the disease before enrichment's start were free from signs of the disease or were greatly improved . . . thousands of people were helped to better health. News of the success of enrichment reached people in the control area and caused them to demand that their rice be enriched, too.

Other Countries Follow Suit

Word of the excellent results of the Bataan experiment fanned out throughout the world. The largest rice miller in Thailand marketed enriched white rice with success in 1951. In that year, also, the Puerto Rican government enacted legislation requiring that all white rice sold there be enriched, beginning early in 1952. Since then, enriched rice has been made available to the public in Cuba, Venezuela, Colombia, The Dominican Republic, Taiwan (Formosa), Singapore, and Australia.

South Carolina First To Adopt Enrichment

South Carolina, a state having high per-capita white rice consumption, requires by law that all white rice sold there be enriched with vitamin B_1, niacin, and iron, with vitamin B_2 to be included at a later date. This state has required enrichment of white flour and corn meal since 1942 and 1943 respectively.

Federal Standards of Identity Now In Force

The U. S. Food & Drug Administration established the following Standards of Identity for enriched rice which must contain at least 85% of the minimum quantities, shown below, after a rinsing test. If the method of enrichment does not permit this rinsing requirement to be met, consumer size packages must bear the statement: "Do not rinse before, or drain after, cooking."

	Milligrams per pound	
Vitamin	Min.	Max.
Thiamine	2.0	4.0
Riboflavin*	1.2	2.4
Niacin	16.0	32.0
Iron	13.0	26.0

*Optional pending further study

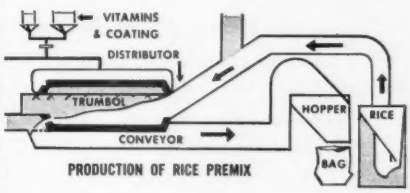
U. S. Federal Specification N-R 351 C requires the same content as the minimum standards shown above.

Popular brands of 'quick cooking' rice are now being enriched with all of the required vitamins.

How Is White Rice Enriched?

The enriching method in widest use throughout the world employs a method developed in the laboratories of Hoffmann-La Roche Inc., pioneers in the research and production of vitamins.

The Roche method impregnates rice grains with thiamine, niacin, (riboflavin, if desired), and iron and adds a final, outer coating of edible material to protect the vitamins against deterioration and preliminary washing and rinsing. For economy large amounts of vitamins are applied to small amounts of rice to make a "premix". One pound of the "premix" is then mixed with a larger quantity (usually 199 lbs.) of ordinary milled white rice at the mill.



PRODUCTION OF RICE PREMIX

What of the Future?

The trend to nutritionally-improved foods for better health is definite. The United States, a world-leader in the enrichment of white flour, white bread, corn meal and grits, farina, pastina, macaroni products, and breakfast cereals is now recognizing the need to enrich milled white rice. *When good foods are made better, everyone benefits.*

This article is part of series on the enrichment of processed cereal grain foods which are enriched for better nutrition. It is published by the Vitamin Division, Hoffmann-La Roche Inc., Nutley 10, New Jersey. An illustrated brochure containing the text of all articles in the series is available at your request without charge.

NEW FOOD ADDITIVES AMENDMENT

Extensive changes are now taking shape in concepts, rules, and procedures governing the uses and official limitations of additives in foods and in food-packaging materials. This far-reaching action results from the passage by the 85th Congress, and signing on September 6, 1958, by President Eisenhower, of the Food Additives Amendment of 1958, Public Law 85–929.

Nearly 500 representatives of food and chemical industries met in Washington, D. C., November 24 and 25, with Food and Drug Administration officials to hear FDA Commissioner George P. Larrick and about twelve of his associates most closely concerned with the new law explain their views and plans for making administrative regulations and obtaining opinions of all who wish to offer comments. The conference was cosponsored by the Food Law Institute, Charles Wesley Dunn, President, and by FDA. B. L. Oser, President, Food and Drug Research Laboratories, New York City, helped arrange for technical representatives from industry who spoke. Principal speakers in addition to Messrs. Larrick, Dunn, and Oser were FDA's Harvey, Rankin, Checchi, Goodrich, Roe, Lehman and others; Peters of the Quaker Oats Co.; Sherwood of Sterwin Chemical; Zapp of Du Pont; Miller of the U. S. Pharmacopeia; and Hand of Cornell University.

A preprint of the First Proposed (administrative) Regulations was given to participants and has been published officially in the *Federal Register*, Dec. 9, 1958, pp. 9511–9517 (available from Superintendent of Documents, Washington 25, D.C., at 15 cents per copy). Thirty days were allowed, from Dec. 9, within which interested parties may file objections and comments. FDA expects to issue the initial basic order on the subject before March 6, 1959, the date when certain parts of the new amendment become effective.

Included in the suggested regulations is a list of 118 food chemicals which are believed by FDA to be exempt from testing requirements of the law because they are generally recognized as safe for their intended use. FDA says the list may be expanded if other chemicals also meet the legal requirements for exemption. Preservatives, buffers and neutralizers, nutrients, nonnutritive sweeteners, colorants (not "coal-tar" dyes), stabilizers, emulsifiers, and miscellaneous additives make up this initial list. Coal-tar colors are subject to different provisions of the FD&C Act. Flavoring materials are to be covered in a later proposal.

Under the title "Scientific significance of Amendment to the food manufacturing industry," F. N. Peters predicted it may be several years before an assessment of its scientific significance can be made — that the viewpoints of men in FDA and in industries will have much to do with whether or not, and how, scientific development in food processing and distribution will be influenced. He suggests industry should exert an optimistic effort to make the new law constructive and should try to apply those parts which offer new benefits. He indicated the mandatory pretesting provision is less of scientific than of public-relations importance, because it only makes mandatory what has long been voluntary practice in most food companies. Lest anyone should have any preconceived aversion to additives, Dr. Peters concluded with the challenging question: "The day may come when consumers will ask for synthetic rather than natural foods; it has happened in textiles, why not in foods?"

R. C. Sherwood, well known to so many readers of CEREAL SCIENCE TODAY, this time spoke on food colorant and flavoring materials, subjects not really in the "core" of this conference, for reasons already stated.

Pertinent publications which will be essential to those closely concerned with this subject include:

1) An early issue (regular or special) of the *Food-Drug-Cosmetic Law Journal* which will carry a complete report on the November 24–25 conference, including answers to questions presented;

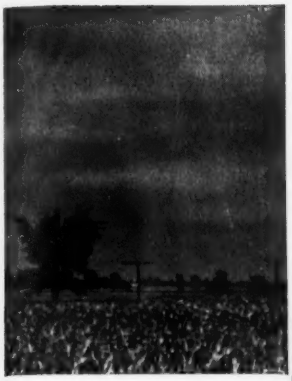
2) The *Federal Register*, issue of Dec. 9, 1958, which contains the first Proposed Order under the new Amendment;

3) The *Quarterly Bulletin* of the Association of Food and Drug Officials of the United States, in which articles are expected by A. J. Lehman on various aspects of additives, and by L. L. Ramsey, analytical chemist of FDA's Food Division, on extractability tests for food-packaging materials.

The new Food Additives Amendment will require more laboratory effort, more consultation, more formalities than heretofore. It will be difficult to retain "trade secrets." Departure from the "poisonous *per se*" doctrine in favor of either 1) exemption, 2) establishment of "tolerances" safe for the intended uses, or 3) clear-cut denial of those substances not safe for specified uses presents a whole new background or framework for all persons concerned in one way or another, including consumers — meaning each member of our vigorously expanding population. Let us all do our best to fulfill the hopes of food and health leaders and of the four Congresses which were instrumental in discussing and finally passing the Food Additives Amendment of 1958.

FRANK L. GUNDERSON

VOLUME 4 • NUMBER 1 • JANUARY 1959



CEREAL SCIENCE today

FEATURES

TECHNICAL SECTION

DEPARTMENTS

STAFF

COVER: Close-up of a feed mill panel board. Courtesy Quaker Oats Company.

CEREAL SCIENCE Today is published ten times per year (monthly except June and August) by the American Association of Cereal Chemists, from 500 South 5th Street, Minneapolis 15, Minnesota. Editorial Headquarters and Circulation Department: University Farm, St. Paul 1, Minn. Advertising Office: 360 N. Michigan Ave., Chicago 1, Ill. Entered as second class matter at the post office at Minneapolis, Minn., under the Act of August 24, 1912.

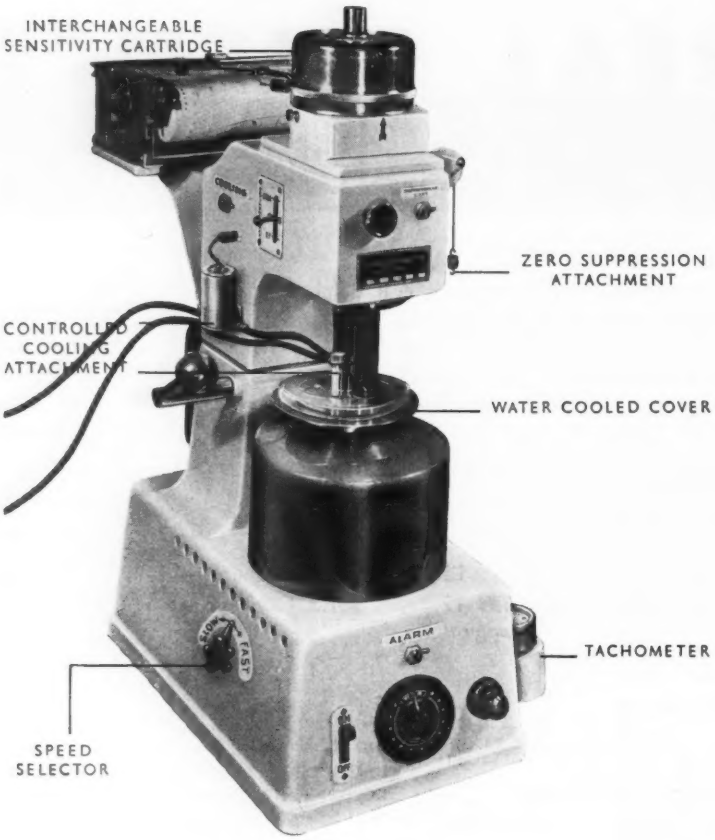
The American Association of Cereal Chemists assumes no responsibility for the statements and opinions advanced by contributors to its publications. Views expressed in the editorials are those of the editors and do not necessarily represent the official position of the American Association of Cereal Chemists.

Subscription rates: 1 year, $3.00; 2 years, $5.00; 3 years, $7.00. Foreign postage: $1.00 per year extra. Back issues available on request. Single copies: 35 cents.

CHANGE OF ADDRESS: Notify Circulation Department, American Association of Cereal Chemists, University Farm, St. Paul 1, Minn. Include both old and new addresses and postal zone number, if any. Claims for missing numbers will not be allowed if received more than 60 days from date of mailing plus time normally required for postal delivery of journal and claim. No claims allowed when subscriber has failed to notify the Circulation Department of a change of address, or because copy is "missing from files."

NEW!

VISCO / amylo / GRAPH



...a time proven Viscometer with a new versatility

by C.W. Brabender

New VISCO/amylo/GRAPH with the same basic time proven design. Now, with 5 factory installed accessories of your selection, it can be "job rated" to suit your requirements.

Fully Recording
Precision Thermoregulation (25°-97°C.)
other ranges on request

Cycle Timer • Pilot Light

Correlation between the new C. W. B. VISCO/amylo/GRAPH and all other amylographs and viscographs is guaranteed . . . even those of old design, if their torque springs are linear and their shaft pin point and bowl bearings are not worn or damaged.

- Solenoid Controlled Cooling Attachment
- Zero Suppression Attachment
- Interchangeable Sensitivity Cartridges (standard amylograph sensitivity plus 3 others)
- Water Cooled Stainless Steel Sample Bowl Cover
- Stepless Variable Speed Control

Write or call C. W. BRABENDER, president, for free diagnostic service and modernization of old style models at nominal cost.

C.W. Brabender
INSTRUMENTS, INC.

50 E. WESLEY STREET
SOUTH HACKENSACK,
NEW JERSEY DIAMOND 3-8425

Editorial

TECHNOLOGY BECOMES MORE complex with applications of new knowledge appearing in geometrical progression. Competitive pressures tend to reduce the time required from development of a new product or process to its full commercial exploitation. The public welcomes progress, but demands that its health be protected and its pocketbook guarded against unscrupulous practices. Government provides laws, enforcement agencies, and a judicial system to meet these needs.

A review of recent volumes of CEREAL CHEMISTRY and of many other research journals will attest to the increasingly important role of governmentally supported research. This support is not confined to laboratories belonging to executive branches of the federal government. A large share of the research funds expended by universities is from contracts or grants made possible by Congressional appropriation. Through taxes, industry supports this research. Full benefit from it is only realized as those who can use the knowledge thus acquired are acquainted with it.

Cereal chemists have a professional interest in many governmental plans, activities, and actions, and in the organizations responsible for them. We are pleased to announce that, beginning with this issue, Frank L. Gunderson, a well-known member of the AACC, has agreed to act as Washington Correspondent for CEREAL SCIENCE TODAY. Dr. Gunderson is a consultant with wide experience in the field of cereal chemistry. He has held important posts both in industry and in the National Research Council, advisory agency to the federal government. His experience gives him not only knowledge of what Washington news is important to cereal chemists and where to get it, but also the ability to interpret its significance. Dr. Gunderson's first report covers some important current activities concerning the new Food Additives Amendment to the Food, Drugs, and Cosmetics Act passed by the 85th Congress. The report appears on page 2.

P.E.R.

CEREALS RESEARCH AT THE

Northern Regional Research Laboratory

By F. R. Senti, Northern Regional Research Laboratory, Peoria, Illinois*

GREAT IMPETUS WAS given to research on the utilization of farm crops when, in 1938, the four Regional Research Laboratories were established in the U. S. Department of Agriculture. Farm surpluses, accumulating during the 30's, had made it increasingly evident that research on utilization must go hand-in-hand with that on crop production, which had traditionally received the greater emphasis in the Department's activities. To provide for this need, Congress—in one section of the Agricultural Adjustment Act of 1938—called upon the Secretary of Agriculture "to establish, equip, and maintain four regional research laboratories, one in each major farm producing area, and, at such laboratories, to conduct research into and develop new scientific, chemical, and technical uses and new and extended markets and outlets for farm commodities and products and by-products thereof."

* This is a laboratory of the Northern Utilization Research and Development Division, Agricultural Research Service, U. S. Department of Agriculture.

The Northern Regional Research Laboratory located at Peoria, Illinois, is one of the four. It is the counterpart of its three sister laboratories at Philadelphia, New Orleans, and Albany, California.

Scope of Research

The Northern Laboratory is centrally located in the corn-, wheat-, and soybean-producing area. It is but natural, therefore, that the commodity responsibilities of the Northern Laboratory are: the cereal grains—corn, wheat, oats, sorghum, and barley, except for food uses of wheat and the nonfermentative feed uses of wheat and barley; and the oilseeds—soybeans and flax. Other responsibilities are the general screening of new plants—to discover those of interest for all the utilization research divisions, as well as further research on selected new crops suited to the Northern region. This discussion is limited to research on cereal grains, but comprehensive programs are in progress on other commodities.

The program of research and development on cereals encompasses three main areas. The first aims toward new or improved products which will widen markets for grains, particularly in industrial and feed uses; the second, toward improved processing methods to separate grain constituents or grain fractions. Fundamental or basic research, the third major area, provides the information needed to support product and process development work currently in progress. It is the source of new concepts and knowledge that will lead to discovery of new products and processes.

Routes to Product Development

As seeds of annual plants, the cereal grains present a continuing source of chemical raw materials. Diverse approaches can be taken to modify or convert them into new substances. As chemical substances with characteristic structures and functional groups, the starches, proteins, and other constituents of cereal

Built in 1940, the Northern Regional Research Laboratory of USDA's Agricultural Research Service conducts utilization research on cereal grains, oilseeds, and screenings of new crops.

grains can be modified in properties or converted to entirely new substances by reaction with a variety of readily available chemicals.

Alternatively to the chemical approach, cereal grains or grain constituents can be converted to new products through the action of yeasts, molds, and bacteria. In recent years microbial synthesis has become an important route to production of molecules with complicated structures, such as antibiotics, vitamins, and amino acids which are difficult to synthesize by conventional chemical methods.

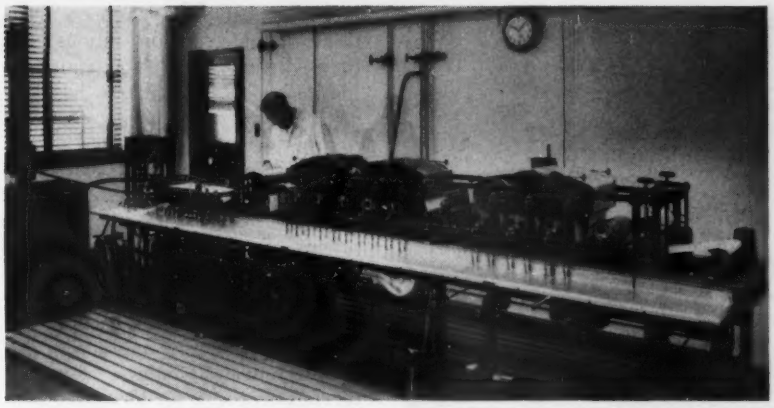
A third approach to new or modified products from cereals lies in genetic modification of the grain's composition. This approach depends on cooperation between the plant breeder and the chemist; the latter's role is to ascertain the extent of modification that the former achieves. This method, in which chemical synthesis within the plant is controlled or directed, is more limited in scope than either of the other two methods, but it has the great advantage that it is unsurpassed in economy. An outstanding result of the genetic method is the development of waxy corn and waxy sorghums, which have become commercial crops within the last two decades.

Each of these three approaches is being followed at the Northern Laboratory.

New Products from Cereals by Chemical Conversion

The major constituent of all cereal grains is starch, comprising about 60 to 70% of their dry weight. It follows that the utility of cereal grains as a raw material must depend in large measure on the properties of starch, either as the separated component or as it exists in the various grain fractions obtained by milling. For this reason several projects deal with chemical and physical properties of starch and with development of new products from starch. Many industrial uses now exist for starch. Indeed, it ranks as one of the most widely used organic high polymers; approximately 1.5 billion pounds are used industrially each year.

A promising new product currently receiving much study in both the laboratory and pilot plant is dialdehyde starch, which is produced by oxidation of starch with periodic acid. Although this reaction has been used many years in elucidating the chemical structure of starch and other carbohydrates, the high cost of periodic acid made it impractical to consider periodate-oxidized starch for any commercial use. This situation was changed with the recent completion by Northern Laboratory chemists of an electrolytic process whereby starch can be oxidized with a small amount of periodate that is continuously regenerated in an electrolytic cell. The extent of oxidation can be varied to yield products ranging from a slightly modified starch to a product in which nearly all the anhydroglucose units have been oxidized.



Laboratory-scale papermaking machine used for preliminary tests on new modified starches or other cereal-derived products as sizing or coating agents.

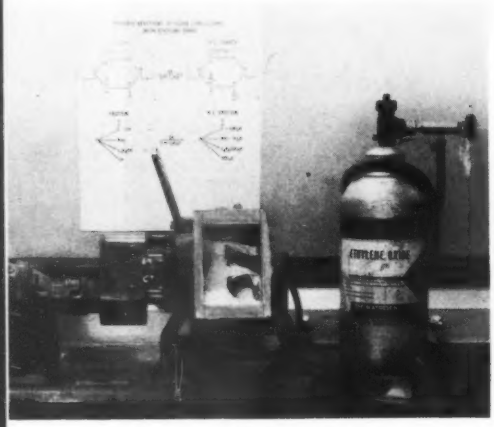
An outstanding property of the dialdehyde starches is their chemical reactivity. Studies at the Eastern Laboratory have shown that highly oxidized starches are effective tanning agents for hides and produce good-quality leathers. This reactivity is not limited to hide proteins, but extends to other proteins and to carbohydrates; it suggests many interesting openings for dialdehyde starches in areas where starch was not previously used.

Starting with dialdehyde starch, a high-polymeric polyelectrolyte can be produced by oxidation of the aldehyde groups to ionizable carboxyl groups. This dicarboxyl starch, recently announced, has thickening properties much superior to those of unmodified starch, and is similar in many respects to certain of the natural and synthetic gums. Many other possibilities exist for new starch products, starting with either dialdehyde starch or with unmodified starch, and research in this area holds promise for substantial outlets for cereal-derived starches.

Proteins and flours are two other cereal products on which chemical modification studies are under way. From the standpoint of cost, proteins are generally less attractive than starch as raw materials for large-scale industrial uses, and advantage must be taken of the properties that lend them to more valuable end uses. Some years ago, for example, synthetic zein fibers for textile use were developed at the Northern Laboratory. After 10 years of commercial manufacture of zein fiber, production has been abandoned, because of marketing problems rather than for technical reasons. More recently, our chemists have developed a method for preparing water-soluble zein. Such products are now being produced commercially.

Because they represent an intermediate stage in the refinement of a grain into its chemical constituents,

Microscopy laboratory for research on grain kernel structure and properties such as the distribution of water in the wheat kernel during conditioning.



Chemical modification of wheat flour, in this mixing apparatus, yields new products whose properties are being investigated relative to industrial utilization.

cereal flours are usually available at lower cost than either of their principal constituents, starch and protein. For wheat products particularly, cost is an important consideration in industrial uses since this grain traditionally commands a higher price than corn, sorghum, or the other feed grains. Thus, it is desirable to exploit any advantage to be realized from the combination of starch and proteins existing in wheat flour, or flour fractions, which can be obtained at relatively low cost by dry-milling processes. With this objective, studies are in progress on the properties obtainable by various chemical modifications of flour fractions.

Fermentative Conversion of Grains

The diverse synthetic activities of microorganisms in converting grain constituents into new compounds offer a promising route to wider utilization of grain. Early work at the Northern Division in this field initiated the antibiotics industry, by disclosing a high-yielding organism and a commercially feasible process for production of penicillin. Current work in this area is on fermentations which will yield antibiotics effective against plant diseases that are caused by microorganisms, such as the rusts, mildews, and blights. Culture filtrates have been found that are effective in greenhouse tests against crown rust in oats, downy mildew on Lima beans, and other mold diseases.

Fermentation processes utilizing corn sugar in their substrates were developed to produce vitamins B_2 and B_{12}. Well over 50% of all domestic vitamin B_2 is produced by a Northern Laboratory process. Supplementation of grain rations with these vitamins, as well as with antibiotics and other adjuncts, has been an important contributing factor to improvements in animal and poultry feeds realized in recent years, particularly for swine and broilers. Last year the Laboratory developed a process for another valuable feed supplement. This is beta-carotene, a precursor of vitamin A, which is produced by a yeast growing on a grain medium containing appropriate adjuncts. Industrial interest in the fermentation process for producing beta-carotene has encouraged exploratory work on microbial production of xanthophylls, and such a study is now under way.

Synthetic activity of microorganisms is not limited to the production of relatively low-molecular compounds like the vitamins and antibiotics. In a defense project during the Korean War the Laboratory was successful in developing fermentation processes for producing dextran, a high-polymeric carbohydrate, useful as a blood-plasma substitute. This led to a survey for yeasts, molds, and bacteria capable of transforming starch, or sugars derived from starch, into new polymers with properties needed for applications not now served by starches. One of the new polymers produced from this study, a water-soluble phosphomannan with high intrinsic viscosity, was announced this fall and samples are being distributed for industrial evaluation. This phosphomannan illustrates the complex changes that microorganisms can effect in building polymers from a carbohydrate substrate.

Genetic Modification of Starch: High-Amylose Corn Starch

High-amylose corn exemplifies the third approach in developing new cereal products. As the name indicates, high-amylose corn starch contains more of the linear molecular component, amylose, than is present in ordinary corn starch. Most cereal starches contain about 25% amylose and 75% amylopectin, the branched molecular component. Desirability of starches composed mostly, if not entirely, of amylose lies in the superior mechanical properties of films and fibers of amylose or its derivatives. Investigations at Peoria showed that amylose films were comparable in properties to cellophane films of regenerated cellulose. If it is available at or near starch prices, sizable outlets should develop for amylose in packaging films, a rapidly increasing market. Its digestibility should be an important advantage in packaging of certain foods. Going a step further, high-amylose starches should extend outlets for starch in the paper and textile industries.

Possible genetic variation in the amylose content of corn starch was first demonstrated through the development of so-called waxy maize, which yields starch containing only amylopectin. This work, in which the Northern Laboratory participated, was done during World War II. During the past 10 years, the Northern Laboratory has been engaged in an extensive cooperative program with corn breeders in developing corn varieties with starches of high amylose content. An important part of this program has been chemical analysis of samples of corn from the breeding work to enable the selection of promising crosses. The magnitude of this task can be seen from the fact that during 1957 approximately 9,000 samples were analyzed. Highest amylose content yet found in a starch is 82%. Starches of this kind cannot be commercially available for several years. However, good-yielding varieties having starch of 55 to 60% amylose have been developed to the point where they can be grown commercially in 1960, if there is a demand for this type of starch.

Along with the analytical work on high-amylose corn, a program of utilization research is going on as sufficient quantities of high-amylose corns become available. Included are engineering studies on the wet-milling process for separating the high-amylose starch, and investigations of the chemical and physical properties of the separated starches.

Processing Research

The Northern Laboratory has also worked for several years on improvements in methods for the processing of grain and grain fractions. Just completed is a continuous batter process for separating low-grade wheat flours into high-grade starch and undenatured glutens. In conjunction with this work, a process was developed using conventional drum-

drying equipment to produce dried undenatured gluten suitable for use by the baking industry, at drying cost considerably less than that of conventional vacuum drying.

Another aspect of research on grain processing is our work in cooperation with the Illinois Agricultural Experiment Station on artificial drying of corn; the objective is to determine drying conditions that do not damage wet-milling properties. Artificial drying of corn has become increasingly prevalent with the use of the picker-sheller, which harvests corn at moisture contents of 20 to 30%. Such corn must be dried before it moves into the grain trade. Since overheating causes serious difficulties in the wet-milling process, safe drying conditions must be established.

An area of grain processing in which work is just under way is that of wheat conditioning. Although it is well established that conditioning of wheat prior to milling lowers power consumption during milling and increases flour yield, there is little agreement among millers as to the best method for conditioning wheat; neither is there a good test for determining when wheat is in optimal condition for milling. The Association of Operative Millers has strongly advocated research in this field, believing that results would be valuable, not only in improving separations achieved in conventional roller milling but also in any new milling process which may be developed.

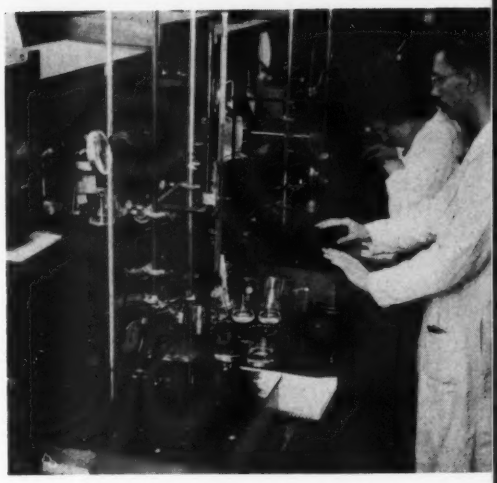
Two lines of work are in progress: the first is an extensive survey of the literature on wheat conditioning, with particular emphasis on reports of work in Europe, where much research and development in conditioning has been done in the past 25 years. A summary of existing factual information gained in this survey will soon be published. The second line of work consists of laboratory studies on the distribution of water within the cellular matrix of the wheat kernel as affected by conditioning treatment. At present, emphasis is on working out methods for determining the concentration of water in kernel tissues. Ultimately, information should be forthcoming on the effect of moisture and temperature during the conditioning process on the physical properties of kernel components and constituents, which should provide a basis for more applied work.

Fundamental and Exploratory Research

Applied research on product and process development at the Northern Division is supported by a program of basic research on the composition, structure, and chemical and physical properties of grains or grain constituents. Some selected lines of work in progress will be mentioned.

One aspect, which is fundamental to improved grain processing, is investigation of the microscopic structure of cereal grain kernels. A particular phase of this work on the corn kernel, just completed, has been in determining the composition of the micron-thick layer of cementing substance that joins the germ and the endosperm. This layer resists clean separation of the germ, particularly in dry-milling of corn, and information on its composition should be helpful in devising conditions for better separation. Somewhat similar work on wheat is in progress at Ohio State University through contract research under supervision of the Northern Laboratory. Here, correlations are being sought between milling quality of soft red winter wheats and kernel properties, such as endosperm cell-wall thickness, and compositional differences as revealed by microstaining of kernel sections.

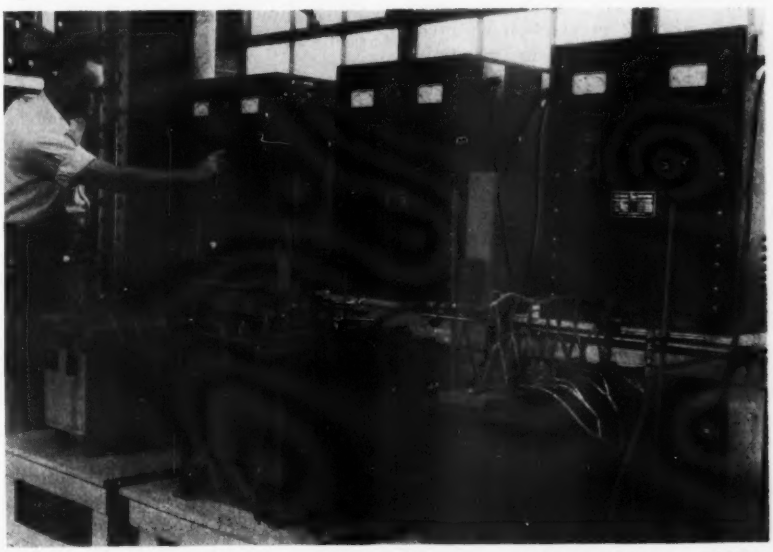
Separation, isolation, and characterization of the component proteins of corn and wheat are other basic studies being carried on in our cereal research. Most interesting results have been obtained with wheat gluten; this protein complex, much studied but little understood, now has been demonstrated to consist of four major electrophoretic components. Moreover, it has been possible to separate these components in relatively pure form on ion-exchange resins. Amino acid composition, molecular size, and other chemical and physical properties of the separate components are now being determined. This information should lead to a better understanding of the unusual cohesive and elastic properties of hydrated whole gluten.



Electrometric titration apparatus being used for determination of amylose content of the starch in corn samples, in cooperative work of chemists and plant breeders on the development of high-amylose corn varieties as a source of new industrial starches.

Encompassed in the basic work are investigations on the chemical nature

Pilot-plant preparation of dialdehyde starch, a promising new cereal product for industrial use. In electrolytic cells, starch is oxidized by a small amount of periodate that is continuously regenerated.



Electrophoresis apparatus for analysis of molecular components in cereal proteins. Electrophoretic pattern shown in inset demonstrates four major components recently found in wheat gluten.

and amount of constituents present in small proportions in grains. Importance of these substances lies not only in the part they may play in the use of grains in animal feed, but also in the use that may be made of by-products from the processing of grain. Some of these compounds may be important in the germination of grain and therefore related to malting and the viability of seeds.

Further importance of such compounds arises from their possible contribution to flavor, odor, and color, these being the factors that influence acceptance of grain products in some uses. In current studies on the nonprotein nitrogenous constituents in corn, for example, 25 compounds have been isolated and identified. This class of compounds is of particular interest in relation to nicotinic acid deficiency in unsupplemented corn diets.

In another study recently completed on carotenoid pigments of sorghum grain, the amount and identity of constituent xanthophylls and carotenes were determined for some newly developed varieties with yellow endosperm, as well as for some commercial varieties with white endosperm. Other compositional research deals with studies on hemicellulose gums of oats, sterols of wheat, and organic acids of barley. The first two investigations are being made under contract research at the University of Minnesota and Iowa State College, respectively, again under supervision of the Northern Laboratory.

Exploratory studies on chemical and microbiological reactions undergone by starches, proteins, and their derived products comprise some of the more important basic studies. For example, a survey is being made to discover microorganisms that produce the essential amino acids lysine, methionine, and tryptophan in high yields, either in their proteins or as free amino acids in fermentation liquors. Such products, produced by fermentation of cereal grain substrates, would provide needed supplements for swine and poultry rations based on grain.

Important to all research on fermentations is the maintenance, expansion, and taxonomic research conducted in the ARS Culture Collection of the Northern Laboratory. It is, perhaps, the largest collection of industrially important microorganisms in the world, containing more than 8,000 authentic pure cultures and many more thousands of only partly classified organisms. These cultures are mainly for use of the Northern and other utilization divisions in the Agricultural Research Service, but some 2,000 cultures are sent out every year to other government laboratories, experiment stations, universities, and industries, both here and abroad.

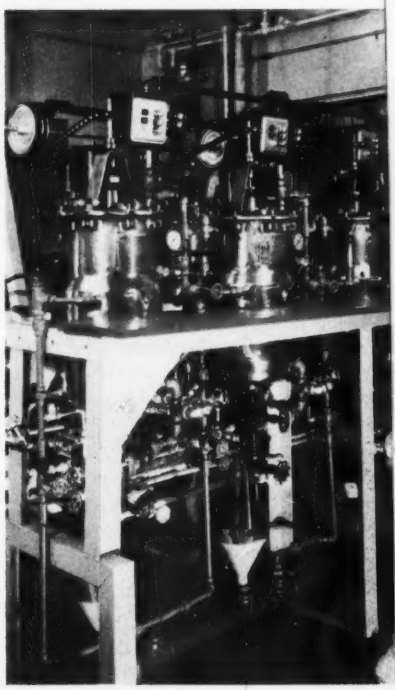
Communication of Results

Dissemination of the results from research and developmental studies is an important responsibility of the Northern Laboratory. This provides the pathway to industrial adoption of processes and products, with the goal of industrial utilization in view. Publication is one avenue for communication of results; completed work on cereals at the Northern Laboratory has been described in some 750 articles published in scientific journals, books, patents, and government bulletins over the last 17 years. Another important avenue is regular meetings with interested trade groups in the cereal field. In addition, many individuals from industries and other research laboratories confer with Northern Laboratory scientists on problems of mutual interests and on the results of our studies. Commercial adoption of newly developed processes and products is actively encouraged through personal contacts with manufacturers, provision of product samples, and cooperative evaluation studies.

Research on Cereals a Major Continuing Program

As outlined, research on cereals is a major part of the Northern Laboratory program. Traditionally, the principal effort has been directed toward new or improved industrial uses for cereal-derived products. Interest in this approach to grain utilization has grown steadily in the past few years. This concern is evident in the recommendations of the President's Commission on Increased Industrial Use of Agricultural Products; and some 20 bills presented in Congress during the last two years have proposed research on industrial outlets for surplus agricultural commodities. When more funds became available during recent years, they were applied to widen the range of research on cereal grains. Work on potential alternative crops, as exemplified by high-amylose corn, was included as a part of the program to fill immediate needs. Meanwhile, a long-range program of basic and exploratory research is maintained to provide a strong foundation for future developments and needs in cereals utilization.

Battery of 20-liter automatically recording vat fermentors for studying temperature, pressure, aeration, and agitation requirements of microorganisms for producing phosphomannan, microbial proteins, or other products in transition of process from laboratory to commercial equipment.



FIFTIETH ANNIVERSARY OF THE

German Federal Research Institute of Cereal Industry

By C. H. Bailey, University of Minnesota, St. Paul, Minnesota

THE BUNDESVERSUCHUNGSANSTALT FUR Getreideverarbeitung celebrated its 50th anniversary at Detmold, Germany, with a Müllerei Tagung on October 8 to 10, 1958. Originally located in Berlin, the Institute moved to Bielefeld during World War II, and later was assigned a structure at Detmold erected by the prewar government for other purposes. A second building was built, the original one was remodeled, and these two buildings, named Liebig Hall and Neumann Hall respectively, thus became available for use as research laboratories. Some years later a third building, Roemer Hall, was erected near by with funds provided by the cereal industries of Western Germany. A commodious and very modern auditorium is housed in it, as well as execuive offices. Following World War II, activities were resumed in the original Institute buildings on Seestrasse, in Western Berlin, and a portion of the staff of the Institute is now located there. The programs of the celebration were held in Roemer Hall at Detmold, and were attended by over 400 chemists, millers, bakers, and government officials from a dozen different countries.

Sessions and Social Events

During the course of the three-day meeting there was presented a review of the proceedings of three other meetings involving cereals and cereal products that had been held in Germany during 1958. The quality of domestic wheats, methods for the determination of baking quality of bread cereals, grain-storage problems, and the defects of old grain received considerable attention during the October meeting. One session was largely devoted to bulk handling of flour. In addition to the formal papers read by specialists from Germany, Italy, Spain, and the United States, there was animated discussion following the presentation of each major topic. Several of the manuscripts and reports have already been published in issues of *Die Mühle* that have been printed since the sessions closed.

The technical sessions held during the three days of the meeting were supplemented by two dinner events,

Dean Emeritus C. H. Bailey

one at Bad Meinberg and one at Bad Salzuflen. Both of these were delightful occasions and reflected the genial relations of the numerous German groups in attendance and the international aspect of the meeting.

Institute Activities and Facilities

The interests and activities of the German Cereal Institute are broad indeed, and varied, as evidenced by the range of its researches and other studies, and the many publications that have been based upon them. It has a distinguished staff, directed by Dr. Paul F. Pelshenke and including numerous Ph.D.'s as well as technologists and engineers. Its researches and other investigations include surveys of the composition and baking quality not only of German wheats but also of wheats from many other lands, milling and baking technology and biochemistry, microbiology including microorganisms involved in grain-storage problems, a starch section, and biochemical studies involving nutrition and including vitamins of cereals and cereal products.

It is evident also that not only are the results of the Institute's studies published promptly, but its professional staff participates actively in numerous industrial and scientific meetings that involve cereals. Thus the industries concerned and their scientific affiliates are kept fully informed concerning the researches done at the Detmold and Berlin laboratories.

The Institute not only has a library housing contemporary literature in the cereal technology field, but also maintains a classified subject index covering tens of thousands of citations to the literature over many years.

The technical staff of the Institute has developed a novel method of preserving specimens of bread and rolls, and has accumulated a large collection of more than 3,000 specimens from many countries.

German Technical Schools

Various German governmental and affiliated agencies maintain technical schools designed to train master millers and bakers. Thus the flour milling school formerly operated at Dippoldiswalde, in what is now Eastern Germany, is replaced by a school at Braunschweig. There are at least five provincial bakers' trade schools

located in different sections of Western Germany. The Bayerische Bäckerfachschule, at Lochham, near Munich, is typical of such schools. It presents four courses per year of 9 weeks each for 32 students in each group, who reside in a dormitory on the campus. In addition to income from the fees paid by all the students, the school is supported by a substantial contribution from the Bavarian Bakers' Association. Before enrolling in such a course, each student has served an apprenticeship of about 3 years. Consequently the students are fairly mature, both in age and experience, at the time of pursuing the course. At the conclusion of the period of instruction the graduates are privileged to subject themselves to a Master Baker's examination. This is partly written, partly practical, and if passed successfully entitles the candidate to a Master Baker's certificate and rating.

In view of the fact that there are more than 9,000 bakeries in Germany, it follows that there is a considerable demand for the services of skilled bakers familiar with both the mechanics and physical techniques, as well as the fundamentals of flour and dough properties, fermentation, dough ingredients, and nutrition.

In addition to these fairly extended and comprehensive instructional courses of 9 weeks, the baking school staffs offer numerous short courses for practical bakers and bakeshop clerks. The instructors also meet at periodic intervals to discuss common problems, including curricula, syllabi of courses, equipment, and related details involved in their instructional practices.

Top, Roemer Hall, Detmold; bottom, two additional buildings of the Institute at Detmold.

Diversified Bread Types

Germany is a land of widely diversified flour and bread types. The flours and meals include not only conventional whole-grain and refined or patent flours, but also many cereal specialties such as supplemented flours, wheat germ, washed bran, and gluten-free flour. It is not surprising, therefore, that one finds an amazing number of types of bread and rolls offered for sale in the thousands of shops, and of packaged cereal products for use in the home. In addition to the regular bakeshops, and the grocery stores that merchandise what might be termed the standard kinds of bread and rolls, there are numerous specialty shops in the larger towns and cities that confine their offerings to "dietetic foods," including unique cereal products designed to fit into special diets or to serve those who suffer from certain maladies that involve special dietary treatment.

In broad terms, one cannot but be impressed with the effective manner in which the varied and numerous interests of all the factors in the German cereal industries have been integrated. Guilds or trade unions, industrial associations, government bureaus, and research institutes have combined to apply their resources and skills to make breads a substantial, delectable, economical item in the German diet.

FUNGUS INFECTION OF GRAIN UPON ARRIVAL AT TERMINAL ELEVATORS

HENRY H. KAUFMANN, Research Department, Cargill, Incorporated, Minneapolis, Minnesota

THE ROLE OF fungi in the deterioration of stored grains has been rather extensively investigated in recent years (3,4,5,6,7,9,10), and it seems well established that certain fungi are a major cause of germ damage in wheat and corn and of rancidity in corn. There is good evidence that the fungi which cause deterioration in storage do not enter the grain until after harvest (10), although the grain may be invaded to at least some extent before it reaches terminal storage. Actually there is almost no evidence as to the degree of infection by these fungi in grains as the grains are received at terminals. If, as has been suggested (4), data on fungus infection of grain are to be used as an aid in evaluating storability of the grain, it is essential that ample evidence be obtained on the amount of infection in the grains as they arrive at the terminal. The work here reported was undertaken to obtain such evidence.

Materials and Methods

Grain Samples. Approximately 1500 samples of wheat and 900 samples of corn were tested during the crop years 1953–54, 1954–55, and 1955–56. Most of the samples were taken when the grains were transferred from the truck to receiving bins at the different terminals; during the peak of the harvest season, an effort was made to obtain daily or weekly average unload samples. The samples were collected in quart or pint metal cans closed with paper-lined screw caps, sent to the laboratory immediately, and tested within a day or two after arrival. There is no reason to suppose that the time which elapsed between collecting and testing the samples had any significant influence on the results.

Tests for Fungi. Two tests were used: 1) mold count, which appears to be a fairly good measure of the number and kinds of viable spores present (5); and 2) the percentage of surface-disinfected seed that yield various fungi, which reveals the number of seeds that have been invaded. These procedures have been developed in work with microbiology of stored seeds (5), and are now more or less standard.

Geographic Regions. As here used, the seven regions comprise: Pacific Northwest — Washington, Oregon; Northwest — Minnesota, North Dakota; Central — Chicago and Milwaukee areas; East — New York, Ohio, Indiana, Michigan; Southwest — Kansas City area, Nebraska, Texas; South — Kentucky, Tennessee, southern Illinois, southern Missouri; Southeast — Pennsylvania, Virginia, North Carolina.

Results and Discussion

The data are summarized in Tables I–VIII. They will be discussed briefly, according to crop, region of harvest, and fungi.

Wheat. Percentage of seeds invaded by *Aspergillus glaucus*, which is the major storage fungus on grain stored at moisture contents of 13 to 15% (11), ranged from a low of 1.1 in the Southeast region in 1955–56 (Table IV) to a high of 20.0 in both the Southeast and South regions in 1953–54 (Table II), and averaged 7.7 for all regions for the three crop seasons. Percentage of wheat seeds invaded by *A. flavus*, *A. candidus*, and *Penicillium* was low in all samples; *A. flavus* was isolated from 8.6% of the seeds from the Southeast region in 1953–54 (Table II), but otherwise infection by these three fungi together never exceeded 4% of the seeds. Spore counts of the four storage fungi combined did not exceed 1,000 per g. in any of the areas in any of the years.

TABLE I

STORAGE FUNGI ISOLATED FROM NEWLY HARVESTED WHEAT — AVERAGE OF CROP YEARS 1953–1956[a]
(Percent of seeds invaded)

REGIONS	*Aspergillus glaucus*	*Aspergillus flavus*	*Aspergillus candidus*	*Penicillium*	*Alternaria*
East	6.6	0.8	0.3	0.8	71.2
Southeast	8.0	3.7	0.5	0.4	66.6
Northwest	10.9	1.1	0.3	0.3	60.5
Central	10.0	1.6	0.1	0.3	83.4
South	9.2	1.8	0.4	0.3	58.2
Southwest	7.5	0.7	0.2	0.1	67.8
Pacific Northwest[b]	1.4	0.0	0.0	0.0	48.4
Av.	7.7	1.4	0.3	0.3	65.2

[a] Wheat from all regions had less than 1,000 spores per gram.
[b] One year only.

TABLE II

STORAGE FUNGI ISOLATED FROM NEWLY HARVESTED WHEAT, CROP YEAR 1953–1954[a]
(Percent of seeds invaded)

REGIONS[b]	*Aspergillus glaucus*	*Aspergillus flavus*	*Aspergillus candidus*	*Penicillium*	*Alternaria*
East	6.1	0.8	0.2	0.4	90.7
Southeast	20.0	8.6	1.5	1.0	59.4
Northwest	11.8	1.3	0.5	0.4	64.1
Central	18.7	3.0	0.3	0.5	82.6
South	20.0	4.0	0.0	0.0	46.0
Southwest	6.7	1.3	0.3	0.0	67.3
Av.	14.0	3.2	0.4	0.4	68.4

[a] Wheat from all regions had less than 1,000 spores per gram.
[b] No data for Pacific Northwest for this year.

TABLE III

STORAGE FUNGI ISOLATED FROM NEWLY HARVESTED WHEAT, CROP YEAR 1954–1955[a]
(Percent of seeds invaded)

REGIONS	*Aspergillus glaucus*	*Aspergillus flavus*	*Aspergillus candidus*	*Penicillium*	*Alternaria*
East	6.6	0.4	0.2	0.1	51.0
Southeast	2.9	2.4	0.1	0.0	71.8
Northwest	13.7	1.3	0.2	0.5	55.2
Central	1.2	0.2	0.0	0.0	84.2
South	4.0	0.8	0.7	0.3	66.3
Southwest	8.1	0.3	0.2	0.2	65.6
Pacific Northwest[b]	1.4	0.0	0.0	0.0	48.4
Av.	5.4	0.8	0.2	0.2	63.2

[a] Wheat from all regions had less than 1,000 spores per gram.
[b] One year only.

Mold counts of parcels of wheat in which damage had developed during storage (2) were far higher than those reported in the present tests. Wheat as lightly infected with storage molds as that represented by the samples here reported on should have a relatively low storage risk; this was borne out, because no unusual problems were encountered in handling and storing this grain.

The percentage of surface-disinfected seeds yielding *Alternaria* ranged from a low of 46% in the South region in 1953–54 (Table II) to a high of 90.7% in the East region in 1953–54, and for all regions averaged 65.2%. *Alternaria* is a so-called "field fungus," which invades the developing or mature seed on plants in the field; it may cause some discoloration of the pericarps but does not cause germ damage or contribute to other sorts of deterioration of stored grain. It is not unusual to isolate *Alternaria* from 100% of surface-disinfected seeds cultured soon after harvest (10), at least from grain harvested in all but the driest regions, and the presence of *Alternaria* in a majority of the seeds usually is an indication that the seeds have been newly harvested and have not been exposed to unfavorable storage conditions. *Alternaria* may persist for some years in very dry seeds (2), but if the moisture content of the seeds is high enough to permit storage fungi to grow, *Alternaria* disappears from the seeds relatively rapidly.

TABLE IV

STORAGE FUNGI ISOLATED FROM NEWLY HARVESTED WHEAT, CROP YEAR 1955–1956[a]

REGIONS[b]	*Aspergillus glaucus*	*Aspergillus flavus*	*Aspergillus candidus*	*Penicillium*	*Alternaria*
East	7.1	1.2	0.4	2.0	72.0
Southeast	1.1	0.2	0.0	0.1	68.8
Northwest	7.3	0.8	0.2	0.1	62.1
South	3.6	0.5	0.4	0.2	62.3
Southwest	7.8	0.5	0.0	0.0	70.4
Av.	5.4	0.6	0.2	0.5	67.1

[a] Wheat from all regions had less than 1,000 spores per gram.
[b] No 1955–56 data for Central and Pacific Northwest regions.

In general, the 1,500 samples of wheat were surprisingly uniform; a majority of the surface-disinfected seeds of all lots yielded *Alternaria*, relatively few of them yielded storage fungi, and the spore count of storage fungi was low. It would seem that a sufficient number of samples from enough different regions and over enough crop years were tested to indicate that the general pattern is typical of wheats that will have a low risk of deterioration in normal commercial storage. As will be discussed briefly later, this implies that the wheat is stored at a moisture content below 14% and that the moisture does not subsequently become unevenly distributed.

Corn. The pattern with corn was by no means as consistent as that with wheat. This probably was to be expected, since corn usually is harvested with a considerably higher moisture content than wheat and normally is stored for some time on farms or in country elevators before it arrives at terminals. There also may be some mixing or blending of old and new crop lots to achieve a given moisture content and grade before the corn arrives at the terminal, and this confuses the picture to some extent.

TABLE V

STORAGE FUNGI ISOLATED FROM NEWLY HARVESTED CORN — AVERAGE OF CROP YEARS 1953–1956

REGIONS	PERCENT OF SEEDS INVADED					SPORES PER GRAM (ADD 000)	
	Aspergillus glaucus	*Aspergillus flavus*	*Aspergillus candidus*	*Penicillium*	*Alternaria*	*Candida*	Others
East	17.2	7.9	0.2	9.1	6.3	920,000	6
Southeast	7.4	21.1	0.2	2.0	14.2	170,000	11,000
Northwest	22.4	4.1	0.8	4.2	7.4	20,000	670,000
Central[a]	24.6	2.5	0.0	10.5	8.0	1,000,000	None
South	31.1	13.5	0.0	13.9	5.9	410,000	670
Southwest[a]	10.7	13.0	0.1	0.6	7.7	1	22
Pacific Northwest	18.3	2.7	0.0	0.0	21.7	None	31
Av.	18.8	9.3	0.2	5.9	10.2	360,000	97,000
Average for E, NW, Central, PNW	20.6	4.3	0.5	6.0	10.9	500,000	170,000

[a] One year only.

TABLE VI

STORAGE FUNGI ISOLATED FROM NEWLY HARVESTED CORN, CROP YEAR 1953–1954

REGIONS[a]	PERCENT OF SEEDS INVADED					SPORES PER GRAM (ADD 000)	
	Aspergillus glaucus	*Aspergillus flavus*	*Aspergillus candidus*	*Penicillium*	*Alternaria*	*Candida*	Others
Southeast	3.5	16.6	0.4	2.9	10.7	28,000	90
Northwest	32.7	8.0	2.2	8.0	0.0	None	2,000,000
South	34.4	23.5	0.0	18.6	0.0	1,000,000	1,900
Av.	23.5	16.0	0.9	9.8	3.6	43,000	7,000

[a] No 1953–1954 data for East, Central, Southwest, or Pacific Northwest region.

TABLE VII

STORAGE FUNGI ISOLATED FROM NEWLY HARVESTED CORN, CROP YEAR 1954–1955

REGIONS[a]	PERCENT OF SEEDS INVADED					SPORES PER GRAM (ADD 000)	
	Aspergillus glaucus	*Aspergillus flavus*	*Aspergillus candidus*	*Penicillium*	*Alternaria*	*Candida*	Others
East	7.5	8.3	0.4	6.2	15.6	1,570,000	None
Southeast	7.4	20.3	0.0	0.3	13.1	70	390
Northwest	12.0	2.5	0.0	2.5	11.1	43,000	2
Central	24.6	2.5	0.0	10.5	8.0	1,000,000	None
South	16.5	12.1	0.1	20.4	13.2	240,000	4
Av.	13.6	9.1	0.1	8.0	10.2	577,000	80

[a] No 1954–1955 data for Southwest or Pacific Northwest region.

Percentage of surface-disinfected seeds yielding all storage fungi *(Aspergillus glaucus, A. flavus, A. candidus,* and *Penicillium)* was 76.5% in the South in 1953–54, 49.1% in the South in 1954–55, and 49.9% in the South in 1955–56 (Tables VI, VII, and VIII). The incidence of all of these storage fungi was almost as high in Southeast, Southwest, and East, and in the Central region in 1954–55, the only year in which corn from this region was tested. The evidence available (9) indicates that corn, like wheat, is not invaded by storage fungi to any appreciable extent before harvest, even in a moist harvest season. This high fungus invasion of corn, as compared with wheat, almost certainly is a result of the corn's remaining moist for a longer period, after harvest, than

does wheat. A low percentage of the seeds of all samples yielded *Alternaria;* evidently infection by *Alternaria* is not so general in corn as it is in wheat. As a corollary of this, the percentage of surface-disinfected seeds that yield *Alternaria* apparently is not so good an indicator of newly harvested corn as it is, in general, with wheat.

TABLE VIII

STORAGE FUNGI ISOLATED FROM NEWLY HARVESTED CORN, CROP YEAR 1955–1956

REGIONS[a]	PERCENT OF SEEDS INVADED					SPORES PER GRAM (ADD 000)	
	Aspergillus glaucus	*Aspergillus flavus*	*Aspergillus candidus*	*Penicillium*	*Alternaria*	*Candida*	Others
East	26.9	7.4	0.0	12.0	3.4	285,000	12
Southeast	11.2	26.4	0.1	5.8	18.8	500,000	34,000
Northwest	22.5	1.9	0.1	2.0	11.2	9	5,600
South	42.4	4.9	0.0	2.6	4.5	2	45
Southwest	10.7	13.0	0.1	0.6	7.7	1	22
Pacific Northwest	18.3	2.7	0.0	0.0	21.7	None	31
Av.	22.0	9.4	0.1	3.8	11.2	31,000	6,500

[a] No 1955–56 data for Central region.

The spore counts in Tables V–VIII are separated into two groups. One comprises *Candida* (apparently *C. pseudotropicalis),* a yeastlike fungus which grows on the outside of the corn kernels and which, when present in large numbers, contributes a sour, yeasty odor. *Candida* requires a high moisture content on the outside of the the seed to develop well, and its presence in very high numbers on some of the samples of corn is an indication that for at least some time after harvest the outer portions of the kernels were moist.

The remaining storage fungi are grouped together in the tables as "others"; some of the samples were very high in spore count of these other storage fungi, some very low. In general, a high count of *Candida* was associated with a low count of the other storage fungi, and a high count of the other storage fungi was associated with a low count of *Candida.* This may indicate some antibiotic effect between *Candida* and the other storage fungi, but more probably it means that *Candida* was present in large numbers on the outside of the kernels when the moisture content there was high, and the other fungi were present in large numbers when the moisture content of the germ was high, since they chiefly invade the germ.

If number of storage fungi present is an indicator of storage risk, one would expect that some of these lots of corn would have given trouble in storage. This proved to be true, particularly those lots stored in the Southeast, South, and Southwest, where storage temperatures generally were higher through the winter storage period than were those in the more northern regions.

Deterioration in stored grain involves not only the percentage of seeds invaded by certain fungi, as indicated by the percentage of surface-disinfected seeds that yield given fungi, and also the degree or extent of this invasion, as indicated by spore count, but also the moisture content and temperature of the grain in storage and the length of time the grain is stored. It is well known that moisture may be transferred by convection currents from one portion of a grain bulk to another (8). This transfer is likely to be greater and more rapid at temperatures of 90°–100° F. than at 50°–60° F. (8), or when there is a large temperature differential, as when the temperature of the bulk of the grain is 60°–70°F. and the outside temperature is either considerably higher or considerably lower than that. This moisture transfer may be of little significance so long as the grain temperature remains below about 50° F., since the storage fungi grow only very slowly then. But if the grain temperature is high enough to permit rapid development of storage fungi, such transfer can lead to rapid and extensive deterioration. Insect infestations may contribute both heat and moisture to adjacent grain (1), and localized outbreaks of storage fungi may do the same. Our rather extensive experience with wheat, for example, indicates that wheat relatively low in storage fungi can be stored with a moisture content of 14% and at a temperature of 65° F. for at least 3 months without damage, but not for 6 months. An outside temperature of 95° F., however, with the grain at a temperature of 65° F., may cause translocation of moisture sufficient to lead to extensive growth of storage fungi and to development of spoilage within 3 months. Grain originally stored in good condition and low in storage molds can be sampled and tested periodically to determine whether the condition of the grain is altering significantly in any portion of the bulk.

Literature Cited

1. AGRAWAL, N. S., CHRISTENSEN, C. M., and HODSON, A. C. *J. Econ. Entomol. 50:* 659 (1957).
2. CHRISTENSEN, C. M. *Cereal Chem. 28:* 408 (1951).
3. CHRISTENSEN, C. M. *Cereal Chem. 32:* 507 (1955).
4. CHRISTENSEN, C. M. *Wallerstein Labs. Communs. XIX (64):* 31 (1956).
5. CHRISTENSEN, C. M. *Botan. Rev. 23*(2): 108 (1957).
6. GOLUBCHUCK, M., SORGER-DOMENIGG, H., CUENDET, L. S., CHRISTENSEN, C. M., and GEDDES, W. F. *Cereal Chem. 33:* 45 (1956).
7. MILNER, M., CHRISTENSEN, C. M., and GEDDES, W. F. *Cereal Chem. 24:* 23 (1947).
8. OXLEY, T. A. The scientific principles of grain storage. Northern Publ. Co.: Liverpool (1948).
9. QASEM, S. A., and CHRISTENSEN, C. M. *Phytopathology 48:* 544 (1958).
10. TUITE, J. F., and CHRISTENSEN, C. M. *Phytopathology 47:* 265 (1957).
11. TUITE, J. F., and CHRISTENSEN, C. M. *Phytopathology 47:* 323 (1957).

BOOK reviews

Our Daily Bread, by E. J. Pyler. Siebel Publishing Co., Chicago, 1958; 157 pp. Price, $4.00. Reviewed by OSCAR SKOVHOLT, Quality Bakers of America, New York, N. Y.

As stated in its preface, "this book is intended to serve as a source of information to readers who have a professional interest in foods and nutrition, which would include the doctor, the dietician, the teacher and student of home economics." The author also expresses the hope that members of the baking industry will find it useful and that interested consumers "may derive from its pages worthwhile information about a major food product and its proper place in a well-balanced diet."

The book opens with a good historical review of the baking industry. It discusses wheat types, describes the structure of the wheat berry, and explains methods used by the milling industry for producing flours of different extractions. Included are numerous tables of data on the composition of various wheats and different flour types. Other ingredients are also discussed in some detail, with emphasis on the part that each plays in the production of bread and its contribution to the nutritional value of the product. The chapter on the technology of breadmaking is an excellent review of equipment and processes now commonly used in commercial baking.

The latter part of the book deals with the composition of bread and its place in diet from a nutritional standpoint. Included is the story of the development of enrichment, which became possible as various factors were isolated and made available for such a program. It details the activities of the whole-wheat advocates and lists much of the evidence from various surveys which convinced most nutritionists that white bread is an excellent food and is given improved balance by "enrichment." In the closing section, "Food faddism and fad dieting," there is an admission that "cranks" are still active and can cause damage to the health of individuals. The promotion they put forth is often for a selfish reason and harms the reputation of white bread as a food, even though based on false premises. An appendix contains standards for all breads as set up under the Federal Food, Drug, and Cosmetic Act.

This book contains much fundamental information in simple form about ingredients and the processes of milling and baking, as well as tabulations of many facts about the "staff of life" from a nutritional standpoint. It should be in the library of everyone in any way connected with the baking industry, and its distribution to various educational and consumer groups would aid in proving that today's enriched bread is an outstanding food from the combined standpoint of cost and nutritional value.

■ ■ ■ ■ ■

Processed Plant Protein Foodstuffs, edited by Aaron M. Altschul; 955 pp.; Academic Press, Inc., Publishers, New York, 1958. Price, $26.00. Reviewed by MAXWELL L. COOLEY, Hoffman-Taff, Inc., Springfield, Missouri.

This volume concerns the sources, production, and processing of plant protein foodstuffs. It tells how they are used and why they are used.

Each of 33 chapters in the book is authored by an expert in his field; thus, a maximum amount of first-hand information is provided. Part I deals with broad aspects of plant proteins and their utilization in animal and human foodstuffs; part II deals with individual commodities. This information on plant proteins is needed by growers, producers, and users.

Feed chemists and nutritionists will find the volume an excellent reference and a valuable addition to their library.

Government and health authorities, who seek to solve the problem of feeding a growing world population, will discover Chapter 30, covering algae, of great interest. It seems likely that algal culture will one day occupy an important place in world food production.

Descriptions of processes used in producing oil meals, as well as other plant protein materials, are sufficiently detailed but at the same time readily understood. The effect of various kinds of treatment (heat, chemical, etc.) on plant protein sources is adequately covered and the data well tabulated.

■ ■ ■ ■ ■

An Introduction to the Chemistry of Fats and Fatty Acids, by F. D. Gunstone; 161 pp. Wiley, New York, 1958. Price, $6.00. Reviewed by R. W. BATES, Armour & Co., Chicago, Illinois.

Dr. Gunstone is a former student and research colleague of T. P. Hilditch, who has contributed a foreword referring to the book as being "primarily intended for the use of Honor students in organic and biochemistry." This reviewer finds it an excellent textbook on the chemistry of fats and related compounds.

The volume covers six general areas, namely: 1) the fatty acids; 2) the chemical nature of fats; 3) the physical and 4) chemical properties of fats and fatty acids; 5) synthesis and utilization of fats in living organisms; and 6) the chief technical applications of fats. The various topics are treated concisely and thoroughly. Under one cover, the reader will find all of the basic reactions of fats and fatty acids, and needs only a fundamental background in organic chemistry in reading and studying the text.

While the author has quoted freely from Prof. Hilditch's monograph *The Chemical Constitution of Natural Fats,* the book is not just a condensation of the Hilditch work. Dr. Gunstone has dealt with the subject from the point of view of the general fat

technologist or nonspecialist. His explanation of the chemistry involved is excellent.

Very few references are given and most are listed only by date (example: Deuel, 1951). The reviewer finds this feature a refreshing one. Fat chemistry has certainly reached a point where many facts are accepted as such and do not need the substantiation of references. Further, too-frequent citing of references tends to interrupt a reader's continuity of thought.

If there are any errors in the book, the reviewer failed to find them. Apparently an excellent proofreading job has been done.

The book is recommended to all fat and oil technologists, and it is believed that all will find it a very useful and comforting addition to their available references.

■ ■ ■ ■ ■

Recommended Methods for the Microbiological Examination of Foods, by the Subcommittee on Methods for the Microbiological Examination of Foods; 207 pp. American Public Health Association, Inc., New York, 1958. Reviewed by HOWARD E. BAUMANN, Pillsbury Mills, Inc., Minneapolis, Minn.

At last a methods book has been published for the microbiological examination of foods. This book will be the first big step in making results between food laboratories more meaningful. Prior to this time, food microbiologists have had to adapt methods from others, such as the dairy bacteriologists, or else develop their own methods.

Harry E. Goresline, who assembled this book, chairmanned a committee of scientists well known in the food field that had been appointed by the coordinating committee on laboratory methods of the American Public Health Association. This committee has done a tremendous job and should be highly commended for the breadth of coverage and the clarity with which methods are presented. The sections devoted to interpretation of results should be of particular help to food microbiologists. Among areas covered are soft drinks; brined, pickled, and salted vegetables; canned foods; carbohydrate products; cereals and cereal products; dehydrated fruits and vegetables; eggs and egg products; fermented foods; poultry; fruit juices and concentrates; frozen foods; meat and meat products; and spices.

There is an interesting section on sanitation indexes and an excellent chapter on food-poisoning types of microorganisms. The culture media and stains recommended are listed in the appendix. The reviewer highly recommends that this book become standard equipment for any and all food microbiologists.

■ ■ ■ ■ ■

Buildings for Research, edited by H. L. Smith, Jr.; 244 pp. F. W. Dodge Corporation, New York, 1958. Price $9.50. Reviewed by L. W. MICHAEL, H. C. JAMES and S. F. BROCKINGTON, The Quaker Oats Company, Chicago, Illinois.

The research laboratory is finally coming into its own in being recognized as a unique building type. Since World War II, and primarily because of the growth of atomic science, laboratory buildings, or more appropriately "research centers," have become a highly specialized form of functional design in building. This book is a compilation of material on research laboratory design published since 1950 by *Architectural Record*, of which H. L. Smith, Jr., is Associate Editor. Each chapter is written by specialists on a design of buildings for particular types of research.

The first section is a broad discussion of laboratory planning and design objectives. It is emphasized that the design details of a laboratory be a joint effort of the architect and the laboratory worker. Joint conferences on design layout are of utmost importance and must precede the more formal work of the architect. Research laboratory design follows a well-established pattern; first, development of the over-all program; second, selection of basic services and conveniences; third, selection of a suitable module; and fourth, the design of the over-all structure to fit. The flexibility of modular design is demonstrated and used to achieve maximum functionality with economy. Not only are individual buildings considered, but analyses of several laboratory plot plans are made.

The second section deals with nuclear laboratories. High- and low-level radiation, inherent in atomic research, creates problems for the architect as well as the laboratory worker, and special features of building design are thereby introduced: the architect must deal with radiation penetration in addition to the more formal types of materials specification. How he handles these problems and solutions for them forms the subject matter for several chapters. The AEC central research laboratory in California is discussed in detail. Particle accelerator buildings are given special attention as requiring unique types of functional design.

The third section deals with industrial laboratory design. To illustrate the scope of complexities involved, industrial engineering research buildings are discussed in detail. These cover IBM, GM and RCA, Trane Company, Armstrong Cork, Johns-Manville, and Farm Equipment. Examples of biological, electronic, and chemical research buildings follow in this section. One wishes that a modern food research laboratory had been included. The closest approach is a description of Corn Products Refining Research Laboratory at Argo, Illinois. In this connection, pilot-plant design, particularly for corn products, is discussed briefly. The importance of proper selection of building sites for research laboratories is emphasized. We note that in industrial laboratories, in addition to the strictly functional purpose behind design, there is a tendency to introduce certain types of styling for purposes other than pure research. A typical example of this is the General Motors Technical Center in Michigan.

The fourth section of the book deals with requirements and design of institutional research buildings. Examples are the university type of building such as the Chemical Engineering Building, University of Minnesota. An example of research building design for military work is the U. S. Naval Post-Graduate Engineering School in Monterey, California. Of particular interest is the Human Centrifuge Test Building. Since the major product of any research laboratory is *ideas*, the comfort, safety, and well-being of laboratory workers are given high priority in design. The details of such amenities as cafeterias, rest rooms, and recreation rooms are given special study. Thus the architect's task is twofold: he must create functional environments for advanced machines and equipment, coupled with sympathetic surroundings for the people who work in the buildings. In all, forty-four research buildings now in operation are described in detail. The book is excellently printed and well bound; it has many photo-

graphs, charts, plans, drawings, and tabular data.

This is a most important and timely book. Though published primarily for architects, it is important reading for all laboratory workers because it points out the need for proper planning and design long before the architect begins his formal job. It deserves a place in every research library.

■ ■ ■ ■ ■

Advances in Enzymology and Related Subjects of Biochemistry, vol. 20, with cumulative index of vols. 1 through 20; F. F. Nord, ed., vii + 488 pp. Interscience, New York, 1958. Price, $12.50. Reviewed by L. A. UNDERKOFLER, Takamine Laboratory, Division of Miles Laboratories, Inc., Clifton, N. J.

This volume lives up to the usual high standards established for this important monograph series. Twelve diverse topics are reviewed. Except for two topics, the authors are from foreign lands, with two contributions from Russia. The reviews are excellent discussions of the recent work on theoretical aspects, usually supplementing earlier reviews appearing elsewhere. All are well written and completely documented with both American and foreign literature citations.

Kuhn reviewed the "Possible relation between optical activity and aging," including such topics as use of definite antipodes in the organism, synthesis of optically active substances, unidirectional course of biochemical processes, elimination of individual antipodes, and choice of the present system of optical antipodes.

Theorell considered the "Kinetics and equilibria in the liver alcohol dehydrogenase system," especially since 1955. The application of fluorimetry in general enzyme studies and especially to the ADH-DPN-DPNH system is discussed. Latest information on purity, molecular weight, equilibrium constant, dissociation constants, and oxidation-reduction potential is reviewed.

In their review of "The roles of imidazole in biological systems" Barnard and Stein discussed the methods of identifying the imidazole group, and the evidence for these groups in the active centers of biologically active substances including esterases, proteases, carbohydrases, and other proteins and compounds; he also critically examined the present information and our need for more.

Kalckar discussed the enzymes and reactions of galactose metabolism, and recent knowledge of their role in galactose-defective mutants such as in congenital galactosemia.

Gottschalk gave an interesting review on neuraminidase, its substrate and mode of action. This enzyme is found in certain pathogenic viruses and organisms, and acts upon mucoprotein.

Slater reviewed recent work on "The constitution of the respiratory chain in animal tissues." He has excellently correlated the complex relationship of succinic dehydrogenase, the cytochromes, the substrates, cofactors, vitamins, and inhibitors of the system by which hydrogen is transferred from intermediary metabolites to oxygen in the cell.

"Enzymology of the plastids" was discussed by Sissakian. The genesis, structure, methods of isolation, and chemical constitution of chloroplasts and other plastids is reviewed, but most consideration is given to the enzyme systems present. While much information remains to be gathered, the plastids are involved not only in photosynthesis but also a variety of other biochemical functions. Enzymes are found which take part in many different biochemical transformations, including formation and breakdown of carbohydrates, lipids, proteins, and high-energy compounds.

Vischer and Wettstein reviewed "Enzymic transformations of steroids by microorganisms." He considers the types of reactions—hydroxylation, epoxidation, ketone formation, hydrogenation, dehydrogenation, and side-chain cleavage; and mixed reactions—the formation, purification, and characterization, cofactors and inhibitors, and specificity of enzymes; reaction mechanisms, and applications.

Davies and Green, in their review of "The mechanism of hydrolysis by cholinesterase and related enzymes," first survey the direct and indirect evidence as to the active groups and intermediate reactions of esterases, and then integrate the various recently proposed ideas into a single theory to explain the activity and inhibition of hydrolytic enzymes.

Kretovich reviewed "The biosynthesis of dicarboxylic amino acids and enzymic transformations of amides in plants" under these headings: enzymic oxidation of dicarboxylic acids, biosynthesis of glutamic and aspartic acids, participation of dicarboxylic amino acids in transaminations, and biosynthesis and enzymic transformations of asparagine and glutamine.

The review of "Pectic substances and pectic enzymes" by Deuel and Stutz attempts to extend numerous previous reviews by considering the literature since 1950. The very complex pectic substances and the behavior of pectic enzymes are still poorly understood in spite of much work, as brought out by the discussions of the chemistry and properties of the pectic substances, and of the behavior of pectin-esterases and polygalacturonases.

Tanner and Beesch, in discussing "Antibiotics and plant diseases," point out that the extension to plants of the successful chemotherapy by antibiotics in man and domestic animals may result from present intensive research. The reports of applications of streptomycin, oxytetracycline, and cycloheximide to diseases of various plant crops are listed and commented on briefly.

Because of the widely diverse nature of the articles they cannot all have equal interest to any one reader, but almost every chemist, biochemist, biologist, and medical research worker will find certain of the reviews of special value, and others of interest in keeping up with the rapid developments of the various areas of enzymology.

■ ■ ■ ■ ■

Technical Editing, ed. by B. H. Weil; 278 pp. Rheinhold Pub. Co., New York, 1958. Price, $5.75. Reviewed by EUNICE R. BROWN, **Cereal Science Today.**

Mr. Weil has skillfully combined the contributions of 20 experts, plus bibliographies, and arrived at perhaps a total of the elements that make up technical editing. The book tells "what" and "why," with some of the "how." While the latter may be scarcely more than a guidepost for the beginner, it stresses the importance of writing simply and concretely. Following Mr. Weil's own broad views on psychological, educational, and professional aspects, the general divisions covered are internal documents; journals; books and manuals; graphic aids and other exhibits.

PREVIEWS from CEREAL CHEMISTRY

The abstracts below are from papers that will appear in the January issue of Cereal Chemistry, Vol. 36, No. 1, 1959.

Effect of Drying on the Physical Properties and Chemical Reactivity of Corn Starch Granules – Roy L. Whistler, J. L. Goatley, and W. W. Spencer.

Modern concepts of starch granule structure consider the outer surface to be identical in chemical composition to the interior. Through studies on changes in physical properties produced by various drying procedures, these investigators at Purdue University advance the theory that the shell of the granule may be modified to be physically different from the starch in the interior of the granule. As moisture content was decreased by warm-air drying, gelatinization temperature was increased, paste viscosities were altered, and chemical reactivity decreased.

• • •

The Distribution of Ash in the Wheat Kernel – J. J. C. Hinton.

Millers have long used ash content as a measure of flour extraction rate. This paper from The Research Association of British Flour-Millers, Cereals Research Station, St. Albans, England, reports ash distribution as found in hand-dissected parts from four wheats. The ash gradient from outer to inner layers of endosperm differed in the four wheats, leading to differences in the curves relating mean ash content of the endosperm to "extraction rate." The ash content of the central endosperm (about 50% of the total) of 15 commercial wheat samples had no apparent relationship to ash content of the whole kernel or to kernel weight.

• • •

A Note on Experimental Wet-Milling of High-Amylose Corn – R. A. Anderson and V. F. Pfeifer.

Plant breeders are having some success in developing corn varieties in which the proportion of amylose is considerably higher than the 27% present in ordinary corn starch. Small quantities of corn have been produced with as high as 82% amylose in the starch. In this paper two workers at the Northern Utilization Research and Development Division of the U. S. Department of Agriculture describe pilot-plant wet-milling of a corn with 54% amylose in its starch. Separation of starch was more difficult than with ordinary corn. The starch granules were spherical and smaller than those of regular corn starch.

• • •

Discoloration in Rice: Some Studies on Its Nature and Effect on Nutritive Value – H. S. R. Desikachar, S. K. Majumder, S. V. Pingale, and V. Subrahmanyan.

This contribution from the Divisions of Biochemistry-Nutrition and Storage-Preservation, Central Food Technological Research Institute, Mysore, India, describes a brownish discoloration encountered in rice. It was accompanied by a slight reduction in protein solubility and growth-promoting value. Similar discoloration was induced in white polished rice by incubation for 48 hours at 25% moisture. Evidence is presented that the discoloration is microbiological in origin.

• • •

Studies on the Brew Process of Bread Manufacture: The Effect of Sugar and Other Nutrients on Baking Quality and Yeast Properties– J. W. Lee and W. F. Geddes.

Data in this paper are from Dr. Lee's thesis for the Ph.D degree at the University of Minnesota. Yeast extract was found to be superior to casein hydrolysate, an aqueous extract of flour, or various synthetic media as a nutrient in brews. Gas production and baking quality of brews containing glucose or sucrose were equally satisfactory. Regardless of the sugar used in the brew, maltose content of the dough increased throughout fermentation. Maltose content of bread made by the brew process was higher than in bread made by the sponge and dough procedure.

• • •

The Estimation and Location of Methoxyhydroquinone Glycosides in the Wheat Grain. – D. G. H. Daniels.

Methoxyhydroquinone (MHQ) glycosides occur in wheat germ. It was hoped that a method for analysis of MHQ in flour would permit estimation of germ content in flour. A method was developed. Results when applied to wheat showed MHQ is present in tissues other than germ. Although 60-70% of the MHQ was in the germ, its distribution in wheat grain appears to parallel that of thiamine.

• • •

Flour Granularity and Cookie Quality. I. Effect of Wheat Variety on Sieve Fraction Properties–William T. Yamazaki.

Coarse and fine fractions obtained by sifting various flours over a 325-mesh sieve were compared in chemical composition and cookie-spread. Both fractions from hard wheat flours had poor quality in cookies. With soft wheat flours the finer fraction had lower protein content and baked larger cookies than the coarser counterpart. The blended fractions gave greater cookie spreads than would be predicted on the basis of the performance of the individual fractions. This paper is from the U. S. Dept. of Agriculture, Soft Wheat Quality Laboratory at Wooster, Ohio.

• • •

Flour Granularity and Cookie Quality. II. Effects of Changes in Granularity on Cookie Characteristics – William T. Yamazaki.

Another paper from the Soft Wheat Quality Laboratory reports effects of changing flour granularity by altering temper and milling upon cookie baking quality. Those changes caused by varying temper on a given wheat mix do not affect cookie diameter within reasonable limits. Excessive reduction of flour lowers quality, probably by mechanical injury to starch. Factors other than granularity are more important to cookie quality.

• • •

Gelatinization and Pasting Characteristics of Rice Varieties as Related to Cooking Behavior–John V. Halick and Vincent J. Kelly.

Cooking characteristics of various rice varieties were compared. It was found that water uptake by whole rice at temperatures from 72° to 82° C. was closely related to gelatinization characteristics as measured in the amylograph. Gelatinization temperatures were inde-

pendent of amylose content, but maximum viscosity of hot paste and gel formation on cooling were related to amylose content. The authors are with the Crops Research Division, U. S. Dept. of Agriculture, and Gerber Products Co., respectively.

• • •

The Baking Quality and Maltose Value of Flour Irradiated with Co^{60} Gamma Rays—C. C. Lee.

Loaf volume of bread was decreased when the flour was irradiated with Co^{60} gamma-rays at dosages of 0.25, 0.5, and 1.0 million roentgens. Other observations made on the flour suggest that irradiation increased susceptibility of starch in the flour to hydrolysis by beta-amylose. The work was done in the Department of Chemistry, University of Saskatchewan, Canada.

• • •

The Application of Heat in the Testing of Flours for Cookie Quality—Wm. T. Yamazaki.

This paper from the U.S.D.A. Soft Wheat Quality Laboratory at Wooster, Ohio, describes procedures for physico-chemical testing of soft wheat flours. Experimentally milled flours which showed poor cookie baking characteristics were shown by these tests to show viscosity increases earlier and at lower temperatures in the heating process.

• • •

Study of the Storage Deterioration and Loss of Performance Value of a Military Prepared Chiffon Cake Mix When Stored at 70° and 100° F.—J. A. Miller, C. S. McWilliams, and J. J. McMullen.

In the laboratories of the Quartermaster Food and Container Institute storage tests have been carried out with chiffon cake mixes with four different salad oils, corn, cotton, peanut, and sesame. After one year in air-packed cans at 100° F. there was a slight decrease in baking performance of all the mixes. All of the oils performed well both functionally and flavorwise. Even when high peroxide values were found in the mix with cottonseed oil this did not affect odor or flavor of the baked cake.

• • • People

C. H. Bailey, Dean Emeritus of the Institute of Agriculture, University of Minnesota, has been elected Honorary President of the International Association for Cereal Chemistry. Cereal chemists, meeting in Vienna in December and representing 19 different countries, took this step "to show their appreciation of the great contributions" made by Dean Bailey throughout his long and distinguished career.

C. C. Fifield returned recently from Bogota, Colombia, and Lima, Peru. His trip was made in the interests of wheat quality improvement.

• • • Products

Sterilization of dog food. Intense radiation from a bank of infrared radiant panels is used to sterilize dog food (a mixture of meals and dehydrated meat products) traveling on a vibrating conveyor, at the rate of 5 tons per hour. Details of oven and conveyor design were worked out by sales engineers of the Edwin L. Wigand Co., 7500 Thomas Blvd., Pittsburgh 8, manufacturer of Chromalox Electric Far-Infrared Radiant Panels. The food is heated to 160°F., and is said to receive equal exposure throughout because of uniform radiation and constant vibration. After exposure, it is sealed in moisture-proof bags. The announcement claims a low investment for the electric radiant oven and a cost of only 27 cents per ton (at 1¢ per kilowatt hour). Each heating panel has built-in elements, reflector, insulation, mounting frame, and bus duct to connect with adjacent panels. Release No. 58–18 describes the equipment and process.

• • •

"Boil-in-a-bag" food preparation. A laboratory report issued by Minnesota Mining and Manufacturing Co., St. Paul, is of particular interest to food packagers and those concerned with mass feeding. It tells how "Scotchpak" polyester film No. 20A5 is used for frozen precooked specialty foods and uncooked foods. When removed from the freezer and placed at once in boiling water they are ready for the table in a few minutes. The advantages of the method, such as convenience, retention of nutrients and flavor, and elimination of food waste are set forth in the report. Fabrication, packaging, cooking procedures, and properties of "Scotchpak" are also covered. Copies of the report are available free from the company, Dept. T8-332, 900 Bush Ave., St. Paul 6, Minn.

• • •

The Technicon AutoAnalyzer, a system for continuous automatic chemical analysis, said to detect trace minerals down to parts per billion with 1% accuracy, is announced by Technicon Controls, Inc. The apparatus automates each step of a chemical analysis now performed manually; i.e., measuring, mixing, purifying, processing, comparing and recording, and integrating them all into a continuous flow system to provide accurate analysis with exact reproducibility. In the laboratory, this robot chemist runs 20, 40, or 60 tests per hour without human supervision. It is being used, the maker reports, to analyze levels of concentration of such materials as cyanides, sulfur dioxide, silica, phosphates, iron, chlorides, copper, sulfates, ammonia, sugars, and aluminum. Systems are available for single- or multiple-component determinations. Write: Technicon Controls, Inc., Chauncey, N. Y.

• • •

Dry vitamin A for feeds and premixes. A dry vitamin A with excellent stability and biological activity has been placed on the market by Distillation Products Industries. PGB-250 is a free-flowing form of vitamin A palmitate for use in fortifying feeds, premixes, concentrates, mineral mixtures, and various other products fed to poultry and livestock. It comes in golden-orange spherical particles

in the range of 30–120 mesh, and contains 250,000 USP vitamin A units per gram. The vitamin A palmitate in the particles is protected from air and the destructive pro-oxidant action of minerals by the use of plasticized gelatin and approved antioxidants. Gelatin has superior properties as coating material, being practically impervious to oxygen and thus providing an impenetrable barrier between the vitamin A and destructive minerals. For samples, technical data, and quotations write: Distillation Products Industries, Rochester 3, N. Y.

• • •

Square-cornering recorder response, with tolerance for varying input resistance, is made faster in the Sargent Multi-range precision potentiometric Recorder, and at standard full-scale balancing speed (which is now 1 second) response is without significant overshoot, according to the announcement. Input impedances at any value from 0 to 10,000 ohms on the 1.25 mv. range (5 microvolts/mm) and from 0 to 30,000 ohms on the less sensitive ranges, are specified. Eleven true potentiometric ranges in the 0.1% order of accuracy can be selected on a panel switch of 1.25 mv. to 2,500 mv. full-scale. An additional volt series using a megohm divider is provided for use to 500 volts. Fast balancing and range flexibility are further advantages set forth by Sargent, making the Recorder (S-72150) capable of replacing single-purpose recorders for research and testing operations. Write: E. H. Sargent & Co., Dept. SR, 4647 W. Foster Ave., Chicago 30.

• • • Patter

New Research Center. General Mills, Inc., has announced plans to build a multi-million-dollar research center near its recently opened headquarters in Golden Valley, a Minneapolis suburb. A. D. Hyde, vice-president in charge of research, said that construction is to begin next spring on a main unit composed of laboratories for basic research and flour-milling research, and is to continue in several steps toward completion during the next 5 or 6 years. Sections to be added later will contain laboratories for work in food technology, physics, and analytical research; administrative offices, cafeteria, and other facilities.

• • •

Excessive drying of corn. Artificial drying of corn is being overdone to a dangerously wasteful extent by farmers who do not know that corn dried at temperatures over 140°F. is damaged for the wet-milling process. This is pointed up in the current issue of "Corn," published by Corn Industries Research Foundation, Inc. The corn refining or wet-milling industry buys 140 million bushels of corn a year to produce starch, syrup, sugar, oil, feed, and other products, the article states. Overheated corn shows up at once in the wet-milling process. One effect is a partial "pasting" of the starch, resulting in a "welding" of the starch to the protein; this prevents efficient separation of the two, clogs sieves and filters, and seriously lowers product yields. Yield of corn oil also is reduced, and quality is lowered. Processing losses are encountered in the removal of excess fatty acids. In view of these and other hazards, the corn refiners avoid buying corn from counties where high-temperature commercial dryers are known to be operating.

• • •

New approach for insect control. An insecticide which gives promise of a new and more significantly effective means of insect control is under research and product development by Merck & Co., Inc., chemical division. The key is the microbial pathogen, Bacillus thuringiensis, which can destroy insects that are responsible for immense crop losses. Major advantages over the present organic chemical insecticides are: the pathogen is 1) harmless to all forms of life other than insects; 2) leaves no residues harmful for either human or animal consumption; 3) does not harm crops themselves; 4) does not mutate or change into organisms pathogenic for man, livestock or plants; and 5) will not directly harm such beneficial insects as bees, insect parasites, and predators; 6) there are no known cases of insect resistance build-up to these organisms.

Nationwide attention was drawn to this prospect at a meeting on Oct. 15 of the Western Agricultural Chemicals Association at San Mateo, Calif., in a talk by Irvin M. Hall, assistant plant pathologist at the Citrus Experiment Station, Riverside. Present developments indicate that the new control may be incorporated into dust or liquid sprays that can be dispensed from conventional equipment. Large-scale field demonstration trials in 1959 are planned by Merck.

• • •

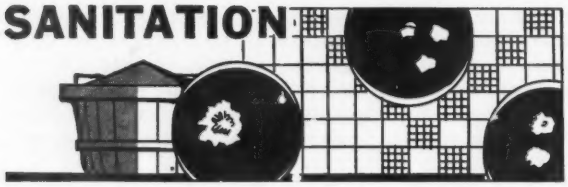
Rust-preventive oil from rice bran. A corrosion- and rust-preventing oil has been developed from rice at the Comet Rice Mills' extraction plant in Houston, Texas. Rice oil also is being used in small quantities as a carrier for insecticides, for making mesh bags, and other industrial uses.

• • •

New developments in vitamin A. At a seminar held in Fresno, Calif., on October 19, recent progress in the chemistry and biochemistry of vitamin A, particularly its use in animal feeds, was discussed by Stanley R. Ames and Robert W. Lehman of Distillation Products Industries. Forms of the vitamin, its metabolism, and methods of physicochemical analysis of materials containing it, were described. Dr. Ames reported on bioassays for evaluating the vitamin A content of various materials that are more rapid and accurate than methods previously used.

Of particular significance to feed producers, according to Dr. Lehman, are methods to determine the stability of the vitamin in feeds and the matter of stability versus availability.

SANITATION



SANITATION TRAINING SCHOOL

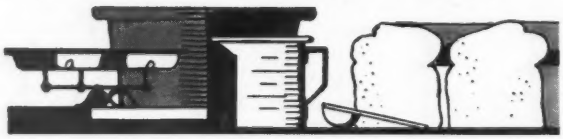
The second of the series of AACC Sanitation Training Schools, held in cooperation with the U. S. Food and Drug Administration, is scheduled for February 16 to 21, 1959, in New York City. Excellent facilities have been made available at the New York City Community College of Applied Arts and Sciences, Room 506 (5th floor), 300 Pearl St., Brooklyn 1, N. Y.

The project is the direct result of the work of the Sanitation Methods Committee of the AACC, and will train personnel in the cereal industry in the latest sanitation procedures. This will include methods for determining contaminants in cereal grains and their products through X-ray techniques, and the identification of insect fragments and rodent hairs.

Interspersed in the laboratory studies will be lectures and the use of mimeographed laboratory aids. Each registrant is required to bring his own wide-field microscope and lamp. A nominal registration fee of $6.50 will cover the cost of supplies. Instructors will be furnished by the FDA. (The course outline given in CEREAL SCIENCE TODAY, September 1958 issue, page 192, will be followed exactly.)

Early registration is advisable, since only a limited number can be accepted for attendance at the school. Applications will necessarily have to be acknowledged on a "first come, first served" basis, and any received after the closing date, February 1, may not be accepted. For application forms and further information regarding the course, write Andrew J. Allgauer, Ward Baking Co., 367 Southern Blvd., Bronx 54, N. Y.

BAKING TECHNOLOGY

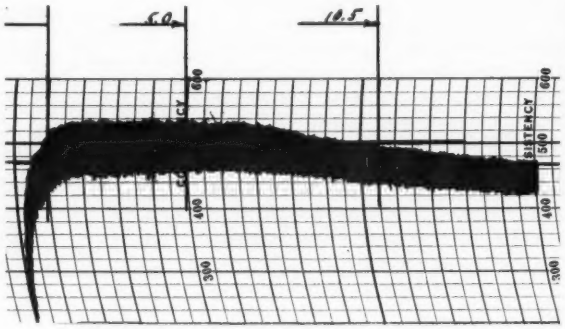


A METHOD FOR EVALUATING FARINOGRAPH RESULTS

A simple procedure, used in our laboratories for several years, has been of great assistance in translating mixing time factors, as obtained by the farinograph test, to production men in the bakeries. It seems to be an improvement over procedures in *Cereal Laboratory Methods*, particularly with flours that tend to give flat curves near the peak point. In such cases, it is difficult to determine just what is the peak or even to find a point that is "immediately before the first indication of weakening" as specified in *Methods* for the determination of Dough Development Time. This point is also important, since the official method defines Tolerance Index as the drop in Brabender Units during the following 5 minutes.

Our method involves a determination of mixing time to a peak point and from the start of mixing until a 30-unit drop has occurred, as measured by the midpoints on the curve. On the chart reproduced below, a horizontal line is drawn through the midpoint of the curve at its highest point. Another horizontal line is drawn at a distance of 30 units below this one. Theoretically, these lines should be at the 500 and 470 unit levels on the chart. Since a peak is not usually obtained at exactly 500 units without many repeated tests, curves are accepted with a deviation of ±20 units from this level. This amount of variation has been shown to be without real significance in effect upon curve length and is acceptable for routine evaluations.

The advantages of this procedure are twofold: First, it is not necessary to accurately list the time when the peak points on the curve. On the chart reproduced below, a find the highest point of the curve in units than to determine the actual peak time. Secondly, the amount of mixing to cause a breakdown, which totals 30 units, is often a better guide to mixing requirements in the shop than the time to the peak. This factor is expressed on the report in minutes, which can be more readily translated into mixing requirements than a tolerance index which is expressed as a drop in Brabender Units.



The "30-unit drop" figure is arbitrary and was selected after some experimenting. A 40-unit drop was first used, but cutting down on the curve length saved time without any apparent loss in value, since a definite dough breakdown is indicated by a 30-unit drop. The production men in our bakeries have become accustomed to look for this time figure to the 30-unit drop, which is called "time to breakdown," and to use it as a guide in setting mixing schedules during a change in flour supplies. It may have maximum value only when flours of the same type are involved in successive shipments, but it is believed to be a considerably better index than any "time-to-peak" figure. It is also more easily understood than any amplification of such a value which is expressed in terms of a drop in units with extended mixing for any given time interval.

Possibly new methods of evaluation should not be suggested, since several are already in the literature and in methods books, but this procedure has appeared to be simpler and more accurate than any other in our experience. Others are urged to try it in order to determine whether it offers any real improvement in the interpretation of results.

OSCAR SKOVHOLT

AACC

LOCAL SECTIONS

Midwest Section set an all-time local-meeting record at its pre-Christmas meeting and party on Dec. 1, with 142 persons present, including a surprise guest in the person of National President Clinton Brooke. Ladies were guests, and entertainment included eggnog, door prizes (123!), and carols led by Stan Brockington with accordion accompaniment.

Melvin Mickevic, a local member, fascinated his audience with slides and story of his "Off-beat safari through the Congo" this past summer, when he visited many tribes including the Baccas of Ubangi Territory, Pygmies of the Ituri Forest, Watusi of Ruanda-Urandi, and Masei of Kenya. The talk mainly covered social habits and native foods, and colored slides showed the preparation of caterpillar stew, ants fried and in pancakes, smoked monkey, roast rat, and stewed snakes. A scene showing a Pygmy beauty parlor with several maidens taking treatments delighted the lady guests.

• • • •

Niagara Frontier Section's annual Christmas party combined bowling with fun of the traditional sort at Thruway Lanes and Restaurant Lounge near Buffalo, on December 6, starting at 6 p.m. A dinner of hot roast beef was served buffet style at 8 p.m. in a private room. Delicious beady brew, made at the Iroquois Ale House by the slow fermentation of a malty mash and flavored with the best of hops, was on tap throughout the evening. Attractive gifts and souvenirs were distributed after the dinner, so lavishly as to renew in recipients a firm belief in Santa Claus.

New York Section members met Dec. 9 at the Fifth Avenue Brass Rail, welcoming as speaker one of their most loyal section members, National President Clinton Brooke. Mr. Brooke disclosed to an attentive audience his views on "The past, present, and future of the cereal chemist." The AACC has members in 26 countries, he pointed out. Major groups of industry represented are flour milling, prepared mixes, breakfast foods, animal feeds, baking, distilling, and brewing. For the future, cereal chemistry holds more challenge than ever, Mr. Brooke declared. Faced with recent developments such as bulk handling of raw materials, continuous breadmaking, and new milling processes, the cereal chemist must be ready to adopt new or revised techniques.

At the next meeting, Tuesday evening January 13, members will hear a talk by Russell Cook, president of the Ambrosia Chocolate Company, Milwaukee.

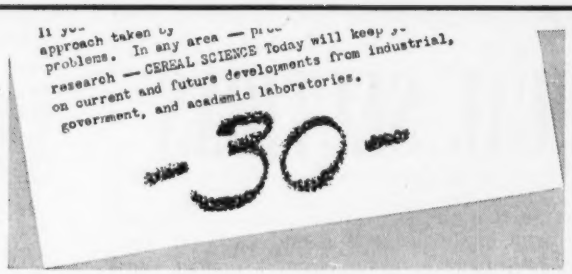
• • • •

Northern California Section met on December 10 for cocktails and dinner at Spenger's Fish Grotto in Berkeley. Harold Olcott, professor of marine food technology, Institute of Marine Resources, University of California, gave a talk on antioxidants for fats and oils. He also discussed his program at the University.

• • • •

Toronto Section had its annual joint meeting with the Association of Sanitarians at Pickfair Restaurant, New Toronto, on November 20. After a fine chicken dinner, H. E. Gray of the Board of Grain Commissioners, Ottawa, talked on "Stored food problems and insect control," illustrating examples of infestation and methods of control with about 80 slides.

The Christmas Party on December 5 was a credit to Gwyn Hughes' direction and arrangements. Members and guests made merry at the Westbury Hotel Banquet Room, with dancing, prizes, refreshments, and the usual visit from Santa Claus.



COMMENT FROM OVERSEAS

In the October 11 issue of *Milling*, the well-known British milling trade paper, an editorial comment was made regarding the rather advanced meeting plans of the AACC. The editorial ended with these words: "This is a change from the reticence of some other organizations, and there are few other organizations that address themselves so earnestly as this Association does to the business side of the meeting."

The officers and headquarters staff of the AACC appreciate these kind words from *Milling* and only hope that our concern with the business side provides a more satisfactory technical session for the registrants. It has been our experience that poor planning of the mechanics of a meeting results in a waste of the technical opportunities available.

If you have ever attended a meeting where the public address system was noisy, or not loud enough, or too loud, you know what a strain it is to pay close attention to the speaker. If the projection of slides is amateurish or the room ventilation poor, you're apt to become distracted. Only when the mechanics are running smoothly —the registration proceeding rapidly and the lecture-room atmosphere conducive to intelligent listening— does the attendant get the full benefit of the meeting.

Human nature being what it is, the average person has just so much patience for any given situation. If a meeting is particularly trying, the individual will probably decide to stay home in the future and save time and money. Therefore, one of the duties of the Executive Secretary is to advise the various local groups in charge of the annual meetings. His advice is based upon experience gained by watching at close range the operations at many different meetings. After talking to a large number of the members in attendance, it's easy to find out what they liked and didn't like. Thus the activities, etc., that were approved will be continued the next year, while those events or procedures that were unsatisfactory will be discontinued.

We know that many scientists dislike too much "business activity" in their professional societies. At the same time, however, they demand professional performance on the part of local arrangements committees, even though these committees consist of fellow chemists and not "convention givers" by vocation.

One of the first rules in planning any meeting is to have a good location; that is, adequate facilities for the technical sessions, exhibits, housing, etc. This means choosing the right city and the right hotel. While our meetings are small by comparison with those of many organizations, we do have to provide facilities for 600 to 800 persons. If we are to obtain such facilities at a specific time of year, reservations must be made well in advance. It is not unusual for hotels in the U.S. to schedule conventions five or six years ahead. Several years ago the AACC found this out the hard way, and since then we have changed our *modus operandi* quite drastically.

While the officers and staff of the AACC can base many of their decisions concerning convention activities on past experience, there is nothing to replace current comments and suggestions from the membership. If all of us took a few moments at the end of each annual meeting to reflect on the arrangements we liked and on those we didn't like, and communicated our ideas to the officers, we would have a near-perfect meeting the following year. Perhaps a suggestion or complaint box at the registration desk might do the trick?

RJT